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Fodder Canes.

By ARTHUR F. BELL.

THE Sugar Experiment Stations Act gives authority for the control of plantings of fodder canes and this control is being exercised within mill areas.

A mill area is defined as the general area, of both assigned and unassigned land, which embraces the lands assigned to the particular mill. That is, for example, if the assigned land ran in two forks up adjacent creeks, then the unassigned area between these forks would be included in the "mill area."

Fodder canes are just as likely to harbour diseases as canes grown for milling and consequently it would be illogical to impose control upon planting of milling canes, while ignoring fodder canes. Accordingly, cane which is grown for fodder purposes within a mill area must be either one of the varieties approved for milling or an approved fodder cane as set out hereunder:—

Variety of Sugar-cane.	Mill Area.
Uba, Co. 290, and "Improved Fodder Cane"	Mossman, Hambledon, Mulgrave, Babinda, Goondi, Mourilyan, South Johnstone, Tully, Macknade, Victoria, Invicta, Kalamia, Pioneer, and Inkerman.
Uba and "Improved Fodder Cane" ..	Proserpine, Farleigh, Racecourse, Pleystowe, Marian, Cattle Creek, North Eton, and Plane Creek.
90 Stalk, "Improved Fodder Cane," and C.S.R. 1 (also known as E.G.)	Bingera, Fairymead, Millaquin, Qunaba, Gin Gin, Isis, Maryborough, Mount Bauple, Moreton, Eagleby, and Rocky Point.

Returns received from canegrowers earlier in the year reveal the fact that comparatively few grow purely fodder canes and consequently some difficulty may be experienced in obtaining supplies, but the variety 90 Stalk, which is approved for southern mill areas, may be obtained from the Queensland Acclimatisation Society, Lawnton.

The present list of approved fodder canes is only tentative and will probably be revised as soon as further tests are made. Heretofore, the Bureau has not paid attention to this class of cane, but it is probable that a number of our discarded seedlings could be utilized for this purpose, especially some of the vigorous types which are discarded on account of somewhat low sugar content from the milling point of view. In future, our field officers will bear in mind the question of fodder canes when selecting seedlings or when setting out disease resistance trials.

We have mentioned above that this restriction on the growth of fodder canes applies to both assigned and unassigned land within a mill area. Canegrowers receiving this Bulletin would render a good service to their neighbours if they brought this information before the notice of such neighbours as grow cane for fodder purposes but are not suppliers to a sugar mill.

A number of enquiries have been received regarding elephant grass, but it should be noted that there are no restrictions on the cropping of this plant nor do restrictions on fodder canes apply to dairying districts outside the general cane areas.

Further Notes on Sugar Production in Hawaii.

By N. J. King.

SINCE the publication of the writer's report on "Sugar Cane in Hawaii and the United States" in the April issue of the *Cane Growers' Quarterly* certain errors have been noted, and some further information has come to hand from certain agricultural research workers in Hawaii.

It might primarily be pointed out that space and other factors prevented the publishing in full of the report on these countries, and it would appear that the attempt at brevity has robbed certain phases of the report of their full significance. For example, in discussing the method of determination used by the plantations for arriving at their fertilizer programme, reference was made to the Rapid Chemical Methods of soil testing in the plantation laboratories. It was not intended to mean that this was the only criterion of fertility used. Such R.C.M. tests are very frequently confirmed by the Mitscherlich pot method; in this branch of soil testing a series of pots of the soil under consideration is planted with either Sudan grass or *panicum barbinode* (para grass); varying amounts of nitrogen, potash, and phosphoric acid are added to the different pots, while some pots remain untreated with fertilizer, and the resultant crop of grass is weighed at maturity after drying. The weights obtained are found to bear a relationship to the amounts of available nutrients in the soil, and to the amounts of fertilizer added. This method provides a valuable means of arriving at fertilizer requirement of soils, but it is necessary that the work be carried out by trained men and with special equipment. The method is rather costly when large numbers of soils are under test. Then the final test of the soil nutrients and the fertilizer requirement is the field

fertility trial in which plots are laid down with varying amounts of different fertilizers, and the tonnage and sugar content are obtained by weighing and analysis at time of harvest.

An error in the original manuscript which found its way into the printed report was the reference to Olaa plantation on page 150 of the Bulletin. These comments did not refer to Olaa at all as the writer did not visit that plantation. Olaa is widely known as a plantation which does not follow conservative agriculture as we know it. It attempts to eradicate weeds by arsenic spraying, and on account of its very rocky and stony nature, is unable to use standard agricultural implements. Some further errors were in the capacities of irrigation reservoirs on Waialua, and Pioneer Mill pumping capacity. The former figure should be 2½ billion gallons of water, and the latter from 15 to 45 million gallons per day.

On page 154 were published some figures relating to irrigation man day performance on several sections of an irrigated plantation in Hawaii. Later figures which have come to hand show a decided improvement. The following figures are for the period June, 1939:—

Section	1	2	3	4	5	6	7	8
Av. applic. acre inches	5·35	7·62	6·75	4·74	5·40	5·35	7·74	7·55
Av. acres per man day	4·59	3·74	4·22	5·24	4·57	4·73	5·35	5·76

This shows a definite improvement on the figures previously quoted.

A visitor to another country realises only too well that he cannot fully appreciate and understand all their problems in a short two weeks, and it should be clearly understood that any statements made in the report are subject to modification in the light of further information. Taking the Hawaiian plantations on a crop producing basis the writer visited only 26·5 per cent. of the Hawaiian industry. Considering that the sugar production of the Territory is slightly above that of Queensland—although much more compact—one could not cover the entire area in such a short time. The observations made in the report therefore represent what was seen on this percentage of the area. But since some of the plantations visited were of the heavily irrigated type, some partially irrigated, and some growing crops under natural rainfall conditions, it is considered that a reasonable cross section of the industry was observed.

It has been pointed out recently that the line reshaper, or furrow shaper, is as much a controller of weeds as it is a reshaper of irrigation furrows. It is combined frequently with subsoilers in ratoons to make a better job of the weed control and line reshaping after the soil has become packed by harvesting traffic.

Hawaii is passing at present through a period of rapid change—due to unfavourable labour and economic conditions; cultivation and harvesting methods which are the vogue this year will perhaps be out of date next year. Economic stress has forced experimentation upon the plantations—experimentation in mechanical harvesting being the most spectacular at the present period. It follows, of course, that experimentation, economy and efficiency are not always synonymous terms, and that much money may be expended during a period of rapid change in a search for more economical methods. In view of the present international

position, and the threatened shortage of potassic fertilizers, one will watch with interest the result of restricted fertilization on plantations which at present use such large amounts. Agricultural economy has always been closely bound up with the maxim of maximum production at minimum cost. If production can be maintained at the present level with a reduced fertilizer bill, then a further advance will have been made towards the cheap production goal. In a similar way mechanisation of agriculture has, in the last few decades, been the chief method of lowering production costs; we generally introduce mechanisation to reduce labour expenses; but when shortage of labour plus the necessity to reduce costs arrive simultaneously then, indeed, is the problem a serious one, and that is the problem agitating the Hawaiian industry to-day.

Some short reference was made in the report to diseases in Hawaii —or rather the lack of serious ones. Hawaii holds a remarkably fortunate position pathologically, in that the country has none of the major sugar cane diseases, gumming, Fiji or downy mildew. Since diseases are agitating the minds of many growers in Queensland to-day a few words on the reason for Hawaii's freedom would not be out of place. Much of the credit for this freedom must be given to the far-sightedness of the various administrations. In 1905 Hawaii placed a complete embargo on the importation of canes from abroad owing to the risk of introducing diseases and harmful insects. The embargo was lifted in 1923, but only under a rigid quarantine system, whereby imported canes are first kept for 12 months in insect-proof glasshouses on the island of Molokai, where no commercial sugar cane is grown, and then a further 12 months in the field on Molokai. From the abovementioned freedom from these major diseases it is obvious that the quarantine system has been of untold value to the Hawaiian industry. Queensland's experience with H. 109 is that it is extremely susceptible to gumming disease, and this has been the major variety in Hawaii for very many years. One can but imagine what loss to the industry the introduction of gum would have brought about.

The Ploughing-out of Varieties Approved when Planted but now Disapproved.

Section 14 of the Sugar Experiment Stations Act provides that, when a variety of sugar-cane, which was an approved variety at the time of planting, is subsequently disapproved, then that variety may be grown and delivered to a mill only until and during the third calendar year after the calendar year of planting. That is to say, all varieties which were approved for planting in 1937 and were planted in that year, but which are now disapproved varieties, are required by the Act to be ploughed out at the end of 1940. To quote two specific instances as examples: D.1135 was an approved variety in the Millaquin area in 1937, but is now a disapproved variety; the Act, therefore, requires that any fields of this variety which were planted in the Millaquin area in 1936, or earlier, must be completely eradicated at the end of this year. Similarly, for example, any fields of P.O.J.2714 planted in the Bauple area in 1936, or earlier, should be ploughed out at the end of this year.

It was appreciated that, due to various reasons, an absolutely rigid enforcement of this section might impose hardship in individual cases in the first year of the operation of the Act. Accordingly, following representations, the Minister for Agriculture and Stock (The Hon. F. W. Bulcock) has declared that in certain individual cases he is prepared to sanction the issuing of a permit for the growing and crushing of such cane without penalty in 1940. The conditions required by the Minister before the issuing of any such permits are as under—

1. Written application must be made to the Director, Bureau of Sugar Experiment Stations, Brisbane.
2. It must be proved that material hardship will result to the individual from the harvesting and/or ploughing out of the field of cane in question.
3. The Director must satisfy himself that a permit to ratoon or standover the field in question cannot adversely affect the control of disease in the district.
4. Such permits are to be granted only after a thorough examination of each individual case.

Canegrowers making application for relief under this provision should take great care to see that they present all the facts necessary to prove their case, as time will not permit of correspondence for reconsideration of inadequate applications. Amongst other things, it will, of course, be necessary for them to set out the following:—

1. Mill area.
2. Name of grower and address.
3. Variety and date planted.
4. Area of field.
5. Tonnage quota for harvest (including added 12 per cent.).
6. Area, mill estimated tonnage and time of planting or ratooning of all crops standing on farm.
7. Similar details for fields already harvested.
8. Diseases on farm during past three years.
9. Full reasons in support of claim that hardship will be imposed.

Early application for relief will be essential in order to permit of inspections being made before the end of the season. Although applications may be made in respect of farms situated in any part of the State it is anticipated that permits will be issued mainly in the southern districts, where the position has been complicated by the growth of standover crops.

It must be emphasised that relief along these lines will apply only to varieties which were approved varieties at the time of their planting. *No consideration can be given to varieties which were disapproved at the time of planting; such varieties must be ploughed out at the end of* 1939 *in all districts.*

A.F.B.

Feeding of Working Horses on Cane Farms.*

By M. White.

THERE are text book standards for feeding horses when idle, at light, medium, or heavy work, but so many factors enter into successful horse management that set standards, if slavishly followed, may be more harmful than useful. For example, opinions will differ widely as to what is hard work. In ploughing, much depends upon the condition of the ground, the type of soil, the slope, and the season. The state of the farming implements is also important. The condition in which harness is kept, the weather, and, in the tropics, even the colour of the animal, all have a bearing on how hard a horse can be expected to work. Finally, the temperament of the horse and the skill of the driver cannot be too strongly emphasised. It follows, then, that any instructions given must be regarded as guides only, and the common sense of the owner will decide whether or not he is feeding his horses well enough for the work he expects them to do.

For simplicity, the amount of food to be offered daily is expressed in pounds of food to each hundred pounds liveweight of horse. A heavy, well-built draught will weigh from 1,700 to 1,800 lb. A well-grown spring cart type will be in the neighbourhood of 1,100 lb.

For all practical purposes, the cane farmer may class his foods under three main headings:—

(1) Roughage, which is mainly for filling and comfort;

(2) Carbohydrate concentrates for energy production;

(3) Protein concentrates for maintenance of muscle and organs.

Where foods are of good quality, the vitamin content is adequate. Extra minerals should be supplied as rock salt for working horses. Roughage may be supplied as grass, hay, green crops, or cane tops (chop-chop).

The second group includes the cereals, their by-products, and molasses. While oats is the best single feed for horses, its use in the canelands is restricted because of other cheaper, and more easily procured grains. Wheat is not widely used though its by-products, bran and pollard are well known. In glut years, with a low ruling price, such as at present, some wheatmeal of good quality may profitably be fed even in maize-producing centres. At present this is also true of barley. Grain sorghums are rapidly coming into prominence and may, within the next few years, become serious competitors of maize. Maize is usually the most valuable grain for horses in the cane areas, but farmers should not be wed to the idea that it is the sole grain for their horses. Molasses, as a cheap by-product of his own industry, has a direct appeal to the cane farmer.

The third group includes:—

(*a*) The seed cake preparations, e.g., linseed, cottonseed, peanut, and coconut meals.

(*b*) Meatworks by-products, e.g., sterilized meat and blood meals.

* This article summarises two interesting lectures delivered by Dr. White at the Sugar Agriculture and Tractor School, held at Gatton College in January, 1939.

Idle horses can be kept in good condition on roughage alone. If the food is of poor quality, three to four pounds of molasses daily should be given. Horses at light work require about one and one-third pounds of hay, or four to five pounds of green feed, and a half pound of concentrates, for each hundred pound liveweight. Horses at medium work should be fed one pound of hay, or three to four pounds of green feed, plus three-quarters of a pound of concentrates, for each hundred pound liveweight. Horses at hard work need about the same allowance of roughage as when at medium work, but the concentrate allowance should not fall below one pound, and it might easily be one and one-third pounds, per hundred pound liveweight.

It has already been pointed out that the cheapest roughage in the cane areas is grass and chop-chop. Fodder, however, is largely bought, and a note on the relative values of the common chaffs may not be out of place. Lucerne has one notable advantage over the other common chaffs. When it is used, there is no need to include protein-rich foods (cottonseed, linseed, &c.) in the concentrate allowance. However, if the price of lucerne per ton is greater than that of oaten or wheaten chaffs plus the cost of two hundred pounds of protein concentrate, it is, in general, not worth the extra money.

The concentrates fed are chiefly grains, their by-products, and molasses, but these in the absence of lucerne do not provide sufficient protein in the ration. It is therefore necessary to replace one pound of the grain by one pound of protein concentrate for horses at light work. For horses at heavy work, two pounds are substituted.

As maize is the standard grain used in the cane areas, farmers should know how it may be substituted by other energy-producing foods.

Oats.—About seven pounds of oats may replace six of maize. Oats may entirely replace the maize in the ration.

Barley.—Provided the grain is crushed, barley may be substituted almost pound for pound for maize. Better results are obtained by adding a little bran.

Wheat.—Sound wheat may replace an equal weight of maize, but the grain should be crushed. Heavy feeding of wheat should be avoided, as it may cause colic. It may, however, form half the concentrate mixture for horses on hard work, if the horses are accustomed to it gradually.

Grain Sorghums.—Crushed grain sorghums may be used in place of maize. In the absence of green feed some bran should be included to counteract the constipating effect of sorghum.

Molasses.—Three pounds of heavy molasses may be used in place of two of maize. Molasses should not entirely replace grain in the ration. One-half of the grain ration for hard working horses may be replaced by molasses in the above proportions.

The protein-rich concentrates most commonly used are linseed, cottonseed and peanut meals. These are interchangeable. When coconut meal is fed, only the best quality should be used. It falls slightly below linseed meal as a source of protein but is a richer source of energy. Meat meal of the best quality only, should be used for horses. It should be introduced gradually. A little over one pound of high-grade meat meal will replace two pounds of vegetable protein meals.

In arranging the three feeds for working horses, it is important to reserve about one-half of the total daily roughage for the evening meal. The morning and midday feeds are eaten just before work starts, and these feeds should contain between them, about three-quarters of the energy-producing foods, i.e., the concentrates. Too much roughage in these feeds prevents the horse from eating sufficient concentrates in the time at his disposal—particularly if he is a slow eater. The long overnight spell gives the horse time to digest the bulky evening meal.

Some horses are inclined to "bolt" their food. This may most readily be overcome by using a shallow feedbox at ground level. This makes the food more difficult to "bolt." Another plan, if the corn is grown on or near the farm, is to feed it in cob. Failing the above, the simplest method is to place two or three large smooth stones in the feedbox.

An important point, too often missed in feeding horses, is never to feed musty material, and always to clean out the boxes. The nose bags too should receive attention. They should be turned inside out after use, and at least once a week steeped in soap suds and rinsed clean. Nothing puts a horse off his feed more than the decomposing remnants of previous feeds.

On idle days the concentrate part of the ration *must be* reduced to at least half the normal amount.

The watering of working horses is important. Water in the morning. Just before the midday feed a short draught should be allowed. Water again after the feed. After the day's work, and before unharnessing, the horse should be watered again. If green feed is supplied in the evening meal, horses may not require any more water for the day. If the feed is dry, they usually like another drink.

Effect of War on Fertilizer Supplies.

MATTER OF INTEREST TO CANE GROWERS.

By H. W. Kerr.

WITH the entry of Britain and Australia into the European War, there exists a grave danger that adequate supplies of necessary fertilizers may not be available to farmers in Australia: this is, of course, a matter which vitally concerns the Queensland cane grower.

Immediate action was taken to determine the present position in this State, and a conference of representatives of the fertilizer companies and the Government was held to discuss the outlook. It would appear that there is little to fear in respect of superphosphate supplies, while the availability of sulphate of ammonia should meet normal requirements. But the amounts of potash now in stock or on the high seas gives us reason to believe that action should be taken to utilize what is available to the best advantage.

The matter has still to receive the final consideration of the Government, but as a voluntary effort to safeguard the future, the fertilizer distributing companies have agreed upon a plan whereby the sales of potash will be carefully scrutinised during the ensuing months.

The details of this plan will be made available to those concerned in due course: but we take this early opportunity of informing cane growers of the reason why their orders for consignments of potash or mixtures rich in potash may not be filled. The desirability of utilizing mixed fertilizers of suitable composition has always been stressed by the Bureau: but in times of emergency—and the present is such an occasion—it may be necessary to restrict these mixtures in a manner which will ensure that limited plantfood stocks will be employed for the greatest good of the greatest number.

For instance, all the experiments of the Bureau, to date, have shown no beneficial effects on cane yield from the use of potash in the Burdekin district. Virtually all gains from fertilizers in these parts can be ascribed to the nitrogen of the mixtures. Therefore, we feel confident that the Burdekin farmers can safely restrict fertilizer purchases for a year or two at least, to meatworks manure and sulphate of ammonia, together with superphosphate if desired. This will liberate a quantity of potash for growers on soils deficient in this plantfood.

Similarly, farmers cultivating the alluvials of North Queensland could confine their purchases to similar materials for a year or two, without impairing crop yields at all. These soils are generally rich in potash, notably where complete fertilizers have been used consistently.

It is for the red volcanic soils of the State generally, and the schist soils of North Queensland that potash is most necessary. But farmers should not be stampeded into thinking that unless they make heavy applications this year, they may be in trouble a year hence. On the contrary, the fertilizer companies are acting in the best interests of all, and we are all agreed that light annual applications of this plantfood will confer greater benefits than the immediate consumption of all available stocks, with the risk of nothing for next year.

To sum up, we would advise:—(1) Farmers who are cultivating soils for which Sugar Bureau No. 1 Mixtures are advised, might well confine their purchases to mixtures containing *no potash* for the present; (2) where Sugar Bureau No. 2 Mixtures have been recommended, employ a mixture with a moderate amount of potash; and (3), where Sugar Bureau No. 3 Mixtures are advised, purchase the fertilizer of this type containing the highest percentage of potash available.

It would not be out of place, at this time, to point out also that cane growers could help themselves in respect of sulphate of ammonia purchases for 1940 (should there occur any shortage) by placing as much as possible of their fallow land for 1940 planting under a leguminous green manure crop this Spring. Such a policy would ensure a minimum of nitrogen requirements for cane planted next year.

In conclusion, it is sincerely hoped that, as the position is clarified, it may be possible to announce that ample supplies of potash are coming forward from overseas. If such should be the case, the present rationing plan can be suspended. But it must be remembered that this country suffered an acute shortage of potash in the years 1914-18, when fertilizer requirements were nothing like what they are to-day: and it is always better to play safely than to gamble on an obscure future.

Varietal Trials.

By H. W. Kerr.

IN continuance of the policy of placing promising seedling canes in trial plots on selected farms, to determine their potential commercial value, a large series of such experimental plots will be harvested in all major cane districts during 1939. At the present time a substantial number of these have been cut, and such results as are available are presented in the ensuing pages of the Bulletin. These will doubtless be studied with interest by all growers who are anxious to secure new varieties better suited to their local conditions than those they are at present cultivating.

It is recognised that a period of years,, with plantings on all soil types and with a wide range of weather conditions, is necessary to enable one to estimate the true worth of any cane. It will, then, be understood why any conclusions or observations presented for the individual trials are rather tentative, and are subject to review when further information is to hand.

The following notes summarise our present attitude towards the new canes dealt with in these trials. These should be read in conjunction with the notes prepared by our Pathologist regarding their reaction to pests and diseases: such comments will be found on page 94 of this Bulletin.

Q.4.—This variety has now been discarded, because of its poor sugar content, poor cover, and extreme brittleness.

Q.12.—Its intensive lodging habit, wth poor stooling and cover, and low sugar content condemn it.

Q.2.—This cane has been rather extensively planted in the North during recent years. While not regarded as a good general purpose variety, it possesses definite merit as a resister of grubs, borers and rats. Whether it will ratoon well after grub damage (such cane is usually harvested early) remains to be determined.

Q.10.—Reviewing the 10 trials reported here, in which Q.10 was included, it is found that it exceeded the yield of the standard variety, on the average, by 1·3 tons of cane per acre, and showed practically the same average C.C.S. The past year must be regarded as unfavourable for the variety, as it arrowed freely, lodged, and "shot" at the top eyes. It also suffered rat damage much more than in 1938.

Q.13.—This variety shows definite promise as a good yielder, with high sugar content, and is rather early maturing. On the three trials to date, it has exceeded the standard by 3 or 4 tons per acre. Its ratooning qualities must yet be studied.

Q.19.—This cane is a heavy yielder, and is a good erect type; but it is a late maturer, with rather low sugar, while its resistance to disease does not attain the necessary standard. It will therefore be discarded.

Q.20.—At the Mackay Experiment Station this cane gave a very promising performance, which has been sustained in the trials harvested to date in that area. Its high sugar content, and notably early in the season, combined with resistance to downy mildew disease, warrant its being tested on a wide scale. Plantings have therefore been made this year, in all major areas except the Herbert River district.

P.O.J.2725 and 2878.—These gumming resistant, vigorous growing canes do not enjoy a good reputation in North Queensland, except in the Mossman area, where 2878 is widely planted. On their performance to date they have certainly exhibited their capacity to produce heavy cane tonnages, despite annual arrowing, and their ratooning qualities are beyond reproach. That their C.C.S. returns have been unfavourable must be attributed to the fact that they were harvested in each case early in the season: if left until September or October, a more commendable result would have followed. They are, of course, susceptible to downy mildew disease, but as Disease Control Board officers will be functioning in the areas from Mulgrave north, this aspect of their propagation should be readily controllable.

Juno, Vulcan and Brutus.—These three varieties, bred by the C.S.R. Company, were tested first of all in the Herbert River district, and due to their gum resistance, they were planted in the Mulgrave area, through the courtesy of the company. While Vulcan and Brutus are top-rot susceptible, and the latter is rather a shy stooler, they have given a promising performance to date, and Brutus and Juno have been planted in further trials during 1939. Juno is reputedly an indifferent ratooner, if cut early in the season, and this feature will receive further study.

Brie Brie Estate, Mossman.

Soil Type.—Whitish clay loam. **Nature of Crop.**—First Ratoon.
Age of Crop.—12 months.

YIELDS.

Variety.	Plant Crop.		First Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.
Clark's Seedling..	20·4	14·0	26·4	**17·4**
Q. 4	**24·5**	13·2	**30·9**	13·9
Q. 10	20·7	**14·7**	24·7	16·4
Q. 12	22·0	12·0	23·1	14·4

DISCUSSION.

Variety Q.4 provided the heaviest cane tonnage for both plant and ratoon crops, being about 4 tons per acre better than Clark's Seedling in each year. Its sugar content was, however, not satisfactory, and for this and other unfavourable characteristics, the variety has been discarded.

Q.10 has performed creditably, both in tonnage and C.C.S., and as an average for the crops, was little inferior to the standard cane.

All varieties yielded a very satisfactory crop, considering the adverse conditions which followed ratooning, and persisted throughout the spring.

Messrs. A. S. & F. W. Hardwick's Farm, Mowbray, Mossman.

Soil Type.—Silty alluvial. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	23·8	14·4
Q. 2	23·9	13·6
Q. 10	27·5	14·2

DISCUSSION.

Although the block had been well prepared, the soil when planted was very dry, and the young crop suffered during the dry spring. In the circumstances, the yields recorded were quite fair. Q.10 gave the highest tonnage of cane per acre, and was but slightly inferior to Badila in C.C.S. Q.2 did not perform well on such dry land, while it was quite immature when harvested in July.

W. D. & G. L. Ishmael's Farm, Edmonton.

Soil Type.—Schist loam. **Nature of Crop.**—Plant cane.
Age of Crop.—14 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
S. J. 4	19·7	16·0
Q. 2	20·4	16·0
Q. 10	16·6	17·4
Q. 13	18·4	16·8
Q. 19	18·9	15·6

DISCUSSION.

This trial had a rather unfortunate history; though it germinated well and appeared promising, it later developed irregularly, and while some plots yielded well, others did poorly. The soft cane, Q.10, was also subject to damage by pests.

In the circumstances, few conclusions may be drawn from the results. Q.2 outyielded the other canes, while Q.10 gave the highest C.C.S.

Mr. R. J. Cowie's Farm, Edmonton.

Soil Type.—Schist loam (stoney). **Nature of Crop.**—Plant cane.
Age of Crop.—12 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
S. J. 4	26·4	15·7
Q. 2	28·3	16·4
Q. 10	**28·4**	**17·5**

DISCUSSION.

This trial was planted under ideal conditions of tilth and soil moisture, and it grew reasonably well throughout its growth period. When harvested, all cane was standing, it had not arrowed, and was not affected by pests.

Q.10 led the other varieties both in cane tonnage and C.C.S. Q.2 also outyielded S.J.4, and gave a higher C.C.S. test, in spite of its being cut in August.

Messrs. Provera and Company's Farm, Kamma.

Soil Type.—Schist loam. **Nature of Crop.**—Plant cane.
Age of Crop.—14 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	25·7	**17·0**
Vulcan	28·8	14·8
Juno	30·9	16·2
Brutus	**31·6**	16·2

DISCUSSION.

The gumming-resistant varieties bred by the C.S.R. Company have given a good account of themselves in this trial. The land was in good order when planted, and a very good strike resulted. There was little or no top rot in the crop, and only Juno arrowed slightly. Brutus again showed its shyness in stooling, and the cover was only fair. However, it gave the highest tonnage of cane per acre, with a satisfactory C.C.S.; Juno was little, if any, inferior on both counts, though Badila was definitely highest in C.C.S. when the crop was cut, in September.

Mr. J. McKenzie's Farm, Aloomba.

Soil Type.—Schist loam. **Nature of Crop.**—First Ratoon.
Age of Crop.—12 months.

YIELDS.

Variety.	Plant Crop.		First Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.
S. J. 4	24·9	16·2	25·1	12·0
Q. 4	**27·2**	14·2	**30·3**	12·1
Q. 10	21·7	**16·8**	25·4	**14·5**
Q. 12	24·6	15·2	23·4	14·3

DISCUSSION.

The first ratoon yields were quite satisfactory, in the circumstances, and again Q.4 showed its superiority in respect of cane yield; it excelled the standard (S.J.4) by 5 tons per acre. Q.10 again gave the highest C.C.S. value, and in the ratoons was equal to S.J.4 in cane yield.

Q.4 has been discarded, however, due to its open growth character, its brittleness, and low sugar content, while Q.10 has been planted extensively in this area, in experimental plots.

Messrs. Gadaloff Bros.' Farm, Aloomba.

Soil Type.—Old alluvial loam. **Nature of Crop.**—First Ratoon.
Age of Crop.—11 months.

YIELDS.

Variety.	Plant Crop.		First Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.
Badila	20·3	17·0	27·8	16·5
Korpi	21·6	**17·5**	27·6	**16·9**
P.O.J. 2878	28·5	16·0	32·9	14·3
P.O.J. 2725	**32·5**	14·6	**36·9**	14·9

DISCUSSION.

Conditions for the growth of the ratoon crop were superior to those experienced with the plant cane, though dry weather in the spring operated adversely. The P.O.J. canes ratooned vigorously, and P.O.J.2725 again outyielded all other varieties. It arrowed completely, while 2878 flowered more freely than normally.

Korpi again led the way in sugar content, and on the whole gave a very satisfactory ratoon performance. The P.O.J. varieties would doubtless perform better if harvested when mature: these plots were cut early in August.

Messrs. E. M. & C. H. Bennett's Farm, Aloomba.

Soil Type.—Old alluvial loam. **Nature of Crop.**—First Ratoon.
Age of Crop.—11 months.

YIELDS.

Variety.	Plant Crop.		First Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.
Badila	23·0	16·7	24·5	17·6
Korpi	26·6	**17·0**	25·3	**18·4**
P.O.J. 2878	28·8	15·7	32·2	17·0
P.O.J. 2725	**30·2**	15·0	**33·7**	14·4

DISCUSSION.

All varieties ratooned well, despite the dry spring, and grew satisfactorily when conditions became favourable. P.O.J.2725 outyielded the other varieties, though it arrowed completely; P.O.J.2878 also showed a proportion of arrows. Korpi compared very favourably with the standard in cane yield, and, as for the plant crop, gave the highest C.C.S. value. P.O.J.2725 was very disappointing in respect of sugar content, but doubtless this would have improved substantially had the cane been harvested later in the season.

Mr. C. H. Carne's Farm, Aloomba.

Soil Type.—Schist alluvial loam. **Nature of Crop.**—Plant Cane.
Age of Crop.—14 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	38·5	15·3
Vulcan	37·2	13·6
Juno	40·2	**15·4**
Brutus	**40·9**	14·3

DISCUSSION.

These are the first results of trials conducted by the Bureau with the gum-resistant varieties made available through the courtesy of the C.S.R. Company, by whom they were bred. Despite the dry spell late in 1938, the crop made good progress, and gave a very satisfactory yield. Brutus and Juno both exceeded Badila in cane yield, while Juno was about equal to the standard in C.C.S.

Vulcan and Brutus are, unfortunately, susceptible to red stripe (top rot), while neither is a particularly satisfactory stooler. Their C.C.S. values were also inferior in this trial. Juno definitely appears promising on this showing.

Mr. A. P. Morelli's Farm, Babinda.

Soil Type.—Gravelly loam. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	23·6	**15·6**
Q. 2	**25·8**	13·6
Q. 10	25·6	14·3

DISCUSSION.

All varieties gave only moderate crops on this block; although the Q. varieties appear to be superior to Badila in cane yield, the results were erratic, and no significance can be attached to the small differences recorded. The crop was harvested early in the season, when the Q.2 was obviously immature. Badila gave the highest C.C.S. value.

Mr. F. H. Gilmore's Farm, Mena Creek, South Johnstone.

Soil Type.—Red volcanic loam. **Nature of Crop.**—Plant cane.
Age of Crop.—12 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	26·4	12·3
Q. 2	37·2	8·3
Q. 10	31·0	11·2
Q. 13	34·3	**12·6**
Q. 19	**38·1**	5·8

DISCUSSION.

The results of the trial suggest that all the seedling canes were capable of outyielding Badila on this red volcanic area, while Q.13 showed the best C.C.S. value. However, as the trial was harvested in June, only Q.10 and Q.13 were approaching ripeness, while Q.2 and Q.19 were hopelessly immature. The stools were not strongly rooted in this land, and much of the cane was lodged before harvesting. This applies particularly to varieties Q.10, 13, and 19.

Mrs. C. Kirkpatrick's Farm, Mourilyan.

Soil Type.—Schist loam. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	20·9	**16·2**
Q. 2	**30·0**	14·2
Q. 10	26·2	15·0

DISCUSSION.

Although the growth of all varieties on this plot was not particularly vigorous, the Q. seedlings gave quite a fair performance. Both outyielded the standard, though the latter gave the best C.C.S. return.

Messrs. Omodei & Bombardieri's Farm, Babinda.

Soil Type.—Alluvial loam. **Nature of Crop.**—Plant cane.
Age of Crop.—12 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	35·9	**12·2**
Q. 2	33·8	9·5
Q. 10	33·5	10·1
Q. 13	**36·4**	9·6
Q. 19	33·8	7·8

DISCUSSION.

This trial embraces the most promising northern seedlings produced to date, against Badila as standard. Only Q.13 exceeded the standard in yield of cane per acre, on this site, while Badila was superior to all seedlings in C.C.S. These data do not, however, correctly represent the canes in question. The cane was harvested on the 1st August, when all canes were far from mature: we know that Q.13 usually attains a high C.C.S. when ripe: Q.2 should not be cut before mid-season, while Q.19 is definitely a late variety. (Compare results from the trial on Mr. F. H. Gilmore's farm, South Johnstone, and Mr. J. P. Kelleher's farm, Tully).

Messrs. Suner and Sons' Farm, South Johnstone.

Soil Type.—Red volcanic loam. **Nature of Crop.**—First Ratoon.
Age of Crop.—12 months.

YIELDS.

Variety.	Plant Crop.		First Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.
Badila	31·0	**12·7**	37·0	9·8
Q. 4	36·1	8·3	*	..
Q. 10	**37·6**	11·7	**39·8**	**11·3**
Q. 12	30·8	8·6	*	..

*Ratoon plot yields not determined.

DISCUSSION.

After the plant crop had been harvested, the field was treated uniformly with molasses, at the rate of 10 tons per acre. The benefits from the treatment are reflected in the increased yields of ratoon over plant cane.

Q.4 and Q.12 were discarded from the ratoons, and it was found that Q.10 again exceeded Badila in yield of cane per acre; the trial was harvested in July, when Q.10 was much nearer maturity than the standard, and thus gave the better C.C.S. return.

These results also suggest that Q.10 has merit, and is worthy of further trial; the top eyes of the sticks had "shot" on this area, but the season was abnormally wet. Q.10 showed less borer damage than Badila.

Mr. J. P. Kelleher's Farm, Tully.

Soil Type.—Alluvial loam. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Badila	37·8	11·9
Q. 2	37·7	11·3
Q. 10	34·6	12·3
Q. 13	41·2	11·5
Q. 19	48·2	8·2

DISCUSSION.

This trial area made excellent progress from the start, and maintained good growth until the field was harvested. Q.19 far excelled all other canes in the experiment; Q.10 gave the best C.C.S. return, thus demonstrating its early maturing character. The trial was harvested in July, when none of the canes was mature, and when Q. 19—a late maturer—could not be expected to test well. This variety has demonstrated its capacity to produce a heavy tonnage of cane: but its general disease susceptibilty, late maturity and normal rather low C.C.S. would seem to condemn the variety for commercial purposes.

Messrs. L. and J. Senini's Farm (late J. C. Galletly). Mt. Pelion, Mackay.

Soil Type.—Alluvial silty loam. **Nature of Crop.**—Plant cane.
Age of Crop.—11 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
M. 1900	42·1	10·8
Q. 20	**43·3**	**15·1**

DISCUSSION.

This trial shows the new variety Q. 20 in a very favourable light: it slightly outyielded the standard, M.1900, and was definitely superior in C.C.S. This is not strictly fair to the standard, which is a late maturing variety, as the cane was cut (for plants) early in August. The tests for Q.20 do, however, demonstrate its early maturing character.

Mr. E. N. Iwers' Farm, Cliftonville, via Sarina.

Soil Type.—Forest sandy loam. **Nature of Crop.**—First ratoon.
Age of Crop.—9 months.

YIELDS.

Variety.	Plant Crop.		First Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.
P.O.J. 213	29·6	**17·3**	18·8	**14·2**
Co. 290	**32·7**	16·1	**21·4**	13·2

DISCUSSION.

Co. 290 outyielded the P.O.J. 213 in the plant crop, and again showed its superiority in the ratoons: in each case the yield was about 3 tons per acre heavier. On both occasions the Java cane gave the higher C.C.S., which is customary; but the ratoons were only nine months old when harvested, and probably the Co.290 would have been much better later in the year.

Messrs. Mau and Dunn, Homebush Road, Mackay.

Soil Type.—Brown forest loam. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months.

YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Q. 813	39·2	15·9
Q. 20	36·2	16·5

DISCUSSION.

Both varieties germinated well, but growth was retarded during the dry spell late in 1938. The canes made vigorous growth throughout the wet season, and the yields were very satisfactory.

Q.813 gave the heavier tonnage of cane per acre, which is in accordance with our experience at the Mackay Experiment Station; it was in the ratoons that Q.20 exhibited its definite superiority. The latter again showed its high sugar content, and was superior to Q.813 in this respect.

Gambia Pea Seed.

Following the publication of the results of trial plots of this legume, conducted during the past year, cane growers from all areas have inundated the Bureau with applications for seed.

Arrangements were made with a seed producer to plant an area of Gambia pea last year, in anticipation of a substantial demand. However, he had such a call on his stocks that he sold everything, and had nothing for his own plantings.

We were, therefore, obliged to assemble what seed we could from all possible sources, and managed to get some 700 lb. in all. This has been allotted to the several districts of the State, to be passed out in trial lots to interested growers by our field officers. In addition, a seed grower of the Kingaroy line has disposed of about 400 lb. direct to the sugar areas.

It is anticipated that at least 20 acres will be planted to Gambia pea this spring, for the purpose of seed production. There should therefore exist reasonable supplies in 1940. However, if any cane grower having a small plot this year wishes to play safely, he might collect his own seed.

H.W.K.

Charcoal Gas for Farm Tractors.

Some time ago prominence was given in the Bulletin to a newly constructed tractor which was designed to operate on suction gas, generated from charcoal. Though the trials of this unit appeared to be satisfactory, it is understood that the firm which constructed it does not propose to proceed further with the unit.

Interest in some emergency form of fuel, particularly for use in farm areas, has again been stimulated by the outbreak of hostilities, which may eventually threaten the continuity of supply of motor fuels to this country. At the same time, it is probable that farmers in some areas, where wood is plentiful and fuel oils are expensive, might adopt the charcoal producer unit even for normal use. An interesting article on this subject appeared in a recent issue of the "Agricultural Gazette of New South Wales," and the more important features of this contribution are presented here in brief.

Experimentation with charcoal fuel has been carried out over a number of years, but until recently, successes have been shortlived as a result of ineffective cleaning, resulting in the deposition of tar in the cylinders, and excessive wear due to solid particles of fuel entering the engine. The rapid burning out of grate and fire box was a further shortcoming of earlier types. Two modern burners have been demonstrated in New South Wales during the past two years, and 26 of these units have been put into operation since May last, with a substantial number about to follow. Better cleaning apparatus has removed the tar and dirt problem, and some owners, after limited experience, state that the engine wear is now less than with oil fuel.

Cost figures, based on data from 15 owners, showed:—

Per 10-hour Day.	Full Load.	Light Load.
Charcoal used	4-7 bags.	3½-6 bags
Cost	5s. to 8s. 9d.	4s. 4½d. to 7s. 6d.
Kerosene used	16-24 gallons.	15-20 gallons
Cost	20s. to 30s.	18s. 9d. to 25s.
Actual averages—		
(*a*) Charcoal	6s. 6½d.	5s. 1½d.
(*b*) Kerosene	25s. 1d.	21s. 5d.

With charcoal gas, the lubricating oil retains its body and colour longer, as it is not subject to dilution. Some owners claimed that the oil retained its viscosity and colour for upwards of 150 hours. The average oil costs for the units under review showed—

	s.	*d.*	
With charcoal	1	6	per day.
With kerosene	4	4	per day.

On the basis of a 70-hour week, on full load, the saving in fuel and oil with the charcoal unit was therefore more than £7 per week.

The cost of charcoal is set down at 1s. 3d. per bag of 50-lb., but it is suggested that this could be reduced where the farmer produces his own. Farmers placed nearer the burning plant are able to secure bulk supplies for 1s. 1d. per bag.

It is found that a loss of power of some 13 per cent. is experienced when kerosene is replaced by charcoal gas. It is pointed out that this could be overcome with a cylinder bore $\frac{1}{4}$ inch greater than normal: in some cases, little loss of power could be detected where the bore was increased by only $\frac{1}{8}$ inch.

It is claimed that, with proper care, the fire risk for crop harvesting was not more than when using kerosene. In Western Australia, a large insurance company does not differentiate between kerosene and charcoal fuels in fixing insurance premiums.

It is admitted that charcoal is less convenient than kerosene, for the following reasons:—

1. Loss of time; average, 30 minutes per day;
2. Unit more bulky and less rigid; requires more frequent servicing;
3. Visibility in judging steering space reduced;
4. Accessibility of engine and transmission reduced;
5. Two stays have to be removed to operate belt and pulley drive.

Some farmers consider the plant equally or more convenient for the following reasons:—

1. Simplicity of operation;
2. Not same trouble in maintaining fuel supply;
3. Engine may be allowed to idle for longer period without overheating, and no oil dilution;
4. No cash outlay if farmer burns his own charcoal.

It is further stated that with charcoal, cleaning the plant and sieving and burning charcoal is a dirty job; when the charcoal burns low, the upper half of the burner becomes very hot, which may cause discomfort in hot weather. On the other hand, there are no engine fumes, and the engine runs cooler and more smoothly, with less noise.

Should any owner not be satisfied with charcoal gas, it is pointed out that a change back to kerosene fuel may be made by fitting the normal sleeves and pistons. Moreover, the charcoal gas requires a hot spark, and the magneto must be in excellent condition for the purpose.

Repairs to the charcoal unit involve renewing the grate every two or three years, and the fire box every four or five years. The cost of supplying and fitting a charcoal gas unit amounts to about £105, to which must be added £15 to £20 for converting the engine to suit the charcoal gas fuel.

A significant fact was that all owners interviewed by the writer of the article were entirely satisfied with the functioning of the units.

H.W.K.

Proclamations under the Sugar Experiment Stations Act.

By Arthur F. Bell.

"*The Sugar Experiment Stations Acts, 1900 to 1938,*" provides that Proclamations may be issued from time to time in order to give special application to general provisions of the Act. Since the amendment of this Act in October, 1938, some ten Proclamations have been gazetted. Growers have already been advised by their organisations and the Press of the substance of these Proclamations, but it has been thought advisable at this juncture to issue a summary of them so that ready reference may be made at any time.

For ease of reference the Proclamations set out below are subtitled with respect to the districts to which they apply. We would urge a careful reading of these parts of the summary which refer to each growers' district. It is possible that any Proclamation may be amended and, therefore, it should not be thought that the provisions or boundaries set out in this summary will hold for all time; a note should be made of any amendments which might be gazetted in the future.

Proclamation No. 1: General. Sets out the diseases and pests which are dealt with under this Act.

Proclamation No. 2: General. Provides for regulations for the prohibition of the removal of sugar cane when considered necessary.

Proclamation No. 3: Cairns District. Declares that that portion of the Mulgrave Mill area situated in the Parishes of Sophia, Trinity and Grafton—that is, all Mulgrave lands lying between Babinda and Hambledon—is a quarantine area. On account of the existence of gumming disease no cane (or tops) may be taken out of that area without a permit. No Mulgrave grower should therefore attempt to send plants or tops to any other mill area nor should any Babinda or Hambledon grower attempt to get cane from a Mulgrave farm.

Proclamation No. 4: Childers District. No cane may be taken from other areas into the Isis Mill area or to Hapsburg or Linwood Plantations unless a permit has been granted. The purpose of this Proclamation is to keep downy mildew out of this district; downy mildew is widespread in the Bundaberg district and it has a disastrous effect on P.O.J. 2878.

Proclamation No. 5: Bundaberg, Gin Gin and Childers Districts. Unless a written permit is received from an officer of the Bureau no sugar cane (including tops) may be removed, except when sent to the mill, from any farm on which there has been downy mildew or Fiji disease within the previous three years. In addition, on these farms, the varieties P.O.J. 213, 234, 2725, 2883 or 2878, shall not be ratooned beyond the third calendar year after the calendar year of planting. That is to say, on farms where either of these diseases has been found since 1936 fields of any of the above varieties which were planted in 1936 (or earlier) must be ploughed out at the end of this year, unless a special permit has been granted. Not only the farmer but also the mill will be liable to a penalty if any such cane is crushed.

Proclamation No. 6: *Maryborough District.* Owing to the prevalence of Fiji disease no cane may be taken away (except when sent to the mill) from any farm which is situated within the Parishes of Maryborough, Tinana, Bidwell, Walliebum, and Young. This means that no farmer may sell or give plants (or chop chop) to his neighbour without a permit to do so.

Proclamation No. 7: *Bundaberg, Gin Gin and Childers Districts.* This Proclamation requires that any farmer on whose land Fiji or downy mildew diseases appear, must notify the Director or an officer of the Bureau to this effect within 48 hours.

Proclamation No. 8: *Moreton Mill District.* In order to stop the spread of Fiji disease there has been declared a quarantine area which embraces that portion of the Moreton Mill area which is bounded by the Mooloolah River on the south, the North Coast Railway on the west, and the Yandina-Coolum Road on the north, with the exception of a small area in the vicinity of Mount Ninderry. This small section, which lies north of the Yandina-Coolum Road, comprises farms on Portions 13, 14, 16, 18, 34, 49, 76, 94, 101, 243, 353, 416, 422, and 425, Parish of Maroochy. The Proclamation prohibits the removal (except for the purpose of milling) of sugar cane of any variety from any farm in that area unless a written permit has been issued from the Bureau. It is further provided that on any farm where Fiji disease has been found since 1936, no farmer may plant his own plants of P.O.J. 2878 unless a permit to that effect is issued.

Applications for permits to sell plants, or to use P.O.J. 2878 grown on diseased farms, should be sent to the Director.

Proclamation No. 9: *Moreton District.* Owing to an outbreak of Fiji disease in a small, somewhat isolated area in the Mapleton district, the removal (except for milling) of any variety of cane, or the planting of P.O.J. 2878. is prohibited in the case of any farms situated on Portions 184V, 185V, and 194V, Parish of Maroochy.

Proclamation No. 10: *Childers District.* It is very desirable to keep Fiji disease at an absolute minimum where so much P.O.J. 2878 is grown and consequently a quarantine area has been proclaimed, embracing that part of the Isis Mill area which lies eastwards of a line formed by the Goomeri-Childers Road, the Isis Branch Railway from Childers to Cordalba, and a line drawn due north from Cordalba Railway Station. The quarantine also includes the Fairymead Sugar Coy's plantations. No cane may be removed from that area except for the purpose of milling and no cane may be planted in that area unless the source of plants has been approved in a permit issued by the Bureau.

In the case of the Moreton and Childers quarantine areas (Proclamations Nos. 8 and 10) permits have been posted to all farmers who it is considered might sell or use their own plants. Any farmer who has not received such a permit and considers he is entitled thereto, should apply to the Director.

Tractor Lubrication.*

By K. E. Mason.

AS every user of a tractor knows, its lubrication may be narrowed down to three headings, viz.:—

1. Engine lubrication (kerosene and diesel);
2. Gear case and final drive;
3. Wheels and track lubrication on track type machines.

While the correct lubrication of every part is essential for successful operation, it will be agreed that the engine is the heart of a tractor, and of necessity every owner and operator should have a clear understanding not only of its lubrication requirements, but also of the many demands made on the lubricant.

At the present time the majority of tractors operating in Queensland are of the kerosene type, but during the last few years the diesel tractor has made rapid strides and is gradually replacing the kerosene type; therefore it is necessary to review the problems encountered with both types of machines.

There is no doubt but that manufacturers of automotive units, including tractors, have brought these prime movers up to such a state of perfection that with the use of good quality lubricants and careful attention to the maker's instructions regarding lubrication and operation, exceptional service with a minimum of trouble is being secured over long periods of use. Nevertheless, the old saying "Familiarity breeds contempt" is a very true one; and the nearer to perfection man brings the product of his own creation, the greater is the tendency for some operators of machines to become careless. It is confidently believed that application of the notes which follow will prove of much benefit.

It is first of all advisable to ask what is desired of a lubricating oil in order that it will give complete satisfaction for engine lubrication in both kerosene and diesel type tractors.

ENGINE LUBRICATION.

These requirements may be covered under six headings:—

i. The oil must complete the seal between the piston rings and the cylinder walls in order to maintain compression and prevent a blow-by of the burning gases.

ii. It must not cause ring gumming under the highest temperatures, or even under weak mixture operating conditions.

iii. It must give freedom from sludging so that—

(*a*) Ring sticking due to accumulation of carbon and sludge in the ring grooves does not occur.

(*b*) Oil control rings do not become clogged and therefore inoperative.

(*c*) Heavy deposits of sludge are avoided, thus reducing the frequency of overhauls.

* This is an abstract of a very interesting paper presented at the 1939 Conference of the Q.S.S.C.T. Reprinted by permission of the Society.

iv. It must, as far as possible, provide adequate protection from cold corrosion of working parts during period of inactivity of the engine.

v. It must burn cleanly so as to reduce the formation of carbon deposits.

vi. It must act as a cooling agent for the heat transfer from pistons and cylinders and transmit it to other parts of the engine.

It will be agreed that these main functions place a heavy demand upon an oil for tractor lubrication, especially when it is realised that the film of oil between the moving parts may be less than 1/1000 of an inch thick. This thin layer of oil has to support the whole of the heavy load imposed upon it, and prevent metal to metal contact. In forming the seal for the piston the lubricant is working under very severe conditions and under the very high temperature of the burning gases.

Lubricating Systems.

There are two main types of lubrication:

i. Those which supply the needs of lubrication only.

ii. Those which make use of the oil both as a lubricant and as a cooling agent.

To the first system belong all the trough and splash lubricating systems, and those in which a small measured quantity of oil is fed to each bearing, while to the second system belong all those systems in which oil is fed under pressure directly into the bearings themselves.

It will be readily seen that the main object of using pressure behind the oil is to maintain a continuous circulation of a large quantity of cool oil through the bearings in order to carry away the heat generated there. The amount of oil which actually passes through the bearings depends mainly upon three factors:—

i. The pressure at which the oil is supplied.

ii. The clearance between the shafts and bearings.

iii. The viscosity of the oil.

The pressure indicated on the pressure gauge is no indication of the efficiency of the lubrication, since bearings with wide clearances will allow the oil to flow through more easily and will, therefore, not show such a high pressure, while the bearing which is too tight and which almost prevents any oil at all from flowing through will show a high pressure. The only use of an oil pressure indicator is to show that the oil pump is functioning properly. Where pressure gauges are fitted on tractors it is often found that operators may pay undue attention to the pressure register and by consequently demanding a heavy viscous oil to maintain what they consider a safe pressure, measurably defeat the end they are out to achieve. Where an oil tell-tale is fitted, the safe pressure is determined by the makers and as the tell-tale only gives an indication when this pressure is not reached, differences of opinion are not so likely to arise.

The question of oil pressure is much debated, but is essentially very simple. A certain amount of pressure is, of course, necessary to circulate the oil at a sufficient rate to compensate for its escape from bearings. Beyond this, any further pressure is useless and is only setting up extra strain in the oil pump, unions, etc. The oil film in the bearings is produced and maintained purely in a hydrodynamic way due to the viscosity of the oil and the rotation of the crankshaft. It is obvious that the oil pressure of 20 lb. per square inch or so, which is the usual figure, can do nothing in the way of supporting a load of several tons which may exist on the bearings.

In hot climates particularly, demands for heavier viscosity oils are made on grounds of higher atmospheric temperatures and lower oil pressures, but are actually quite unnecessary. Although bearing temperatures are influenced to some extent by the surrounding air temperature, the main part of the heat which has to be dissipated is carried away by the cooling water, which should be as near to 100°C. (212°F.) as possible, and can never exceed that figure. It is interesting to note that experience has shown quite definitely that, wherever pressure gauges may register, heavier oils are not more necessary under tropical conditions than in temperate climates.

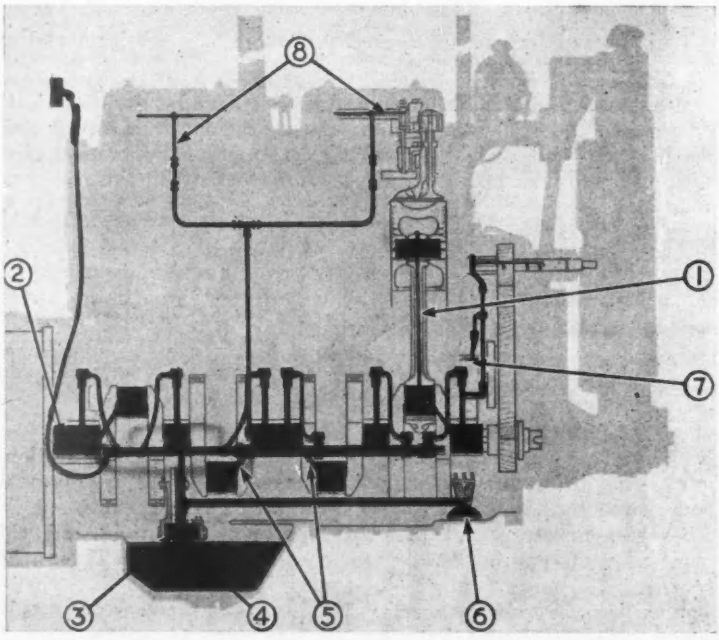

Fig. 13.—Oil Circulation System of Tractor Engine.

1. Connecting rod drilled for pressure lubrication to piston pins. 2. Spiral groove for carrying oil back away from clutch. 3. Auxiliary oil pump to bring oil from forward sump. 4. Main pressure oil pump at lowest part of engine assembly. 5. Drilled holes in crankshaft carry oil under pressure to all crank pin bearings. 6. Auxiliary pump suction bell to return oil to main sump. 7. Camshaft bearing lubricated under pressure. 8. Oil line to valve rocker arms, shafts, and push rod, assuring continuous lubrication.

It is common knowledge that the whole object of lubrication is to prevent wear and power losses due to mechanical friction, and the most severe friction which can take place is that between the piston and the cylinder; also, at this point the heat is greatest and, therefore, the lubrication most difficult.

The cylinder walls obtain their lubrication usually from the oil vapour in the crankcase, which is always in contact with the cylinder walls, giving them a coating of fresh lubricating oil. This being so, it is necessary that the oil used in an engine should not have too high a viscosity or, in other words, be of too heavy a body. It has to form into a mist readily and splash against the walls to provide the necessary lubrication. It must, however, have sufficient viscosity to provide the necessary piston seal. The average operator is aware that when mineral oil is heated it loses its body to some extent, and therefore when comparing the body of two oils it is necessary that comparison should be made at approximately the same temperature. This alteration in viscosity, due to temperature, has a distinct bearing on the working of the tractor, since, on starting up, the tractor would be cold and the oil thicker, whilst after having been run for some period the oil becomes warm and thinner.

Kerosene Operated Tractor.

There is no necessity to go into detail regarding the operation of this type of machine except to state briefly that a mixture of air and vaporised kerosene is drawn into the cylinder on the suction stroke, compressed to approximately 80 lb. per square inch, and, when the piston is almost at the top of its stroke, the mixture is fired by means of a spark plug.

Experience has proved that the main trouble encountered with this type of tractor is dilution of the lubricating oil, which is brought about by unburnt globules of kerosene being absorbed by the oil film finding access down past the piston rings and piston into the lubricating oil. It is imperative to run or operate a kerosene burning tractor with jacket water as hot as possible without, of course, overheating the charge and thereby lowering the volumetric efficiency. By so doing, vaporisation of the fuel is kept at its greatest efficiency, resulting in almost complete combustion and a less tendency for any fuel to remain unburnt and find access to the crankcase oil and bring about dilution.

Crankcase dilution is greatly accelerated at idling periods or when the tractor is only doing light work and not kept sufficiently hot. During these two periods the manifold cools down somewhat, resulting in incomplete vaporisation of the kerosene, and wet gas being carried into the combustion chamber on the suction stroke. The minute globules of kerosene, which represent what are known as the heavy ends, are not completely vaporised, and find their way down past the piston rings, into the crankcase, thus thinning down the oil. Actually this process results in quite an appreciable amount of kerosene getting into the oil after say 50 or 60 hours work. The analyses of oils taken from different makes of kerosene-burning tractors have revealed dilution contents varying from as low as 4 per cent. to as high as 20 per cent.

* * * * * * * *

The enquiring mind would now ask what is the effect of this dilution of the lubricating oil. With the viscosity of the original oil considerably reduced, it will result in the oil film on the cylinder walls not providing as good a piston ring seal as new oil. Since this is so, the tendency for blow-by of gases will naturally increase, which will reduce the operating efficiency and bring about increased dilution. The oil thus contaminated will burn more easily off the cylinder walls and carbonise more readily in the piston ring grooves and behind the piston rings, bringing about ring sticking which will still further reduce the efficiency, and excess cylinder as well as piston ring and piston skirt wear takes place; and so the trouble goes on. Apart from dilution, the crankcase oil becomes contaminated with traces of the moisture which is a product of combustion, in addition to fine particles of bearing metal as well as dust and other extraneous matter.

From this description it will readily be seen why the crankcase oil must be drained out at regular intervals and the machine filled with new oil. Indeed, this might well be considered an imperative prerequisite for satisfactory tractor investment and operation.

To obviate as far as possible the entry of dust, dirt and other extraneous matter into the oil, very efficient air cleaners are fitted to the manifold and in many cases filters are fitted to the breathers on the crankcase. These accessories are fitted to all types of tractors and must be attended to at regular intervals as specified by the makers, it being in the best interests of the machine to do so.

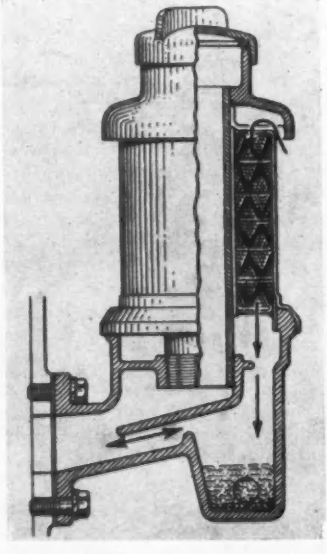

Fig. 14.—Filter fitted to a breather on the crankcase.

Diesel Tractors.

This type of tractor operates differently, in that a charge of clean air is drawn into the cylinder on the suction stroke, compressed to approximately 500 lb. per square inch, and when the piston arrives at a position from 10 to 15° before top dead centre, the fuel is injected and burning commences. Injection of the fuel continues until about 5–10° after top dead centre, depending on the load, and the piston is forced down by the expansion of the gases after combustion. This early injection gives the fuel time to become properly ignited and so to build up a reasonable pressure above the piston by the time the piston starts on its downward stroke.

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Depending upon the type of combustion head fitted to a diesel engine tractor, so will it be known as the direct injection type or the indirect injection type. There are some makers who combine the features of both these types. Experience has shown that over the same periods of operation, in the case of the indirect injection type engine, with efficient fuel injection, there is little tendency for crankcase contamination with unburnt fuel, but there is a tendency for the lubricating oil to be contaminated with fine carbon particles of unburnt fuel during idling or light load periods of operation. In the case of the direct injection type engine, there is a tendency for the lubricating oil to be contaminated with unburnt fuel as a result of idling or light load operating conditions, even with the fuel injection system operating efficiently, but the amount of carbon deposited in the lubricating oil is extremely low.

It goes without saying that it would be as well for the operator of a diesel engine to know the particular type he has in his possession in order that he will be aware of the way in which the lubricating oil will be affected in the crankcase in the event of any fuel injection troubles or excessive idling or light load running of the tractor.

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The full pressure system of lubrication is the one generally adopted in multi-cylinder diesel engine tractors, whereas in single cylinder units the oil is supplied by means of a mechanical lubricator which delivers new oil all the time to the cylinder and bearings. This latter system of lubrication is referred to as the virgin feed principle. It will be readily appreciated that where the full pressure system is adopted the lubricating oil in the crankcase will soon be contaminated with unburnt fuel should any trouble be experienced with the fuel injection system. It is a known fact that faulty sprayers, faulty timing of injection, faulty fuel pumps, or use of the wrong grade of fuel will very soon cause not only contamination of the lubricating oil, but ring sticking on account of the formation of gums from certain combustion products.

The deleterious effect of ring sticking in the case of a kerosene burning tractor has already been stated, but with a diesel-engined machine this factor of ring sticking is far more serious. This means that for the diesel engine user the trouble caused by inferior lubricating oil is greatly accentuated. This is one of the main troubles that the diesel engine manufacturers, as well as oil refiners, have been out to overcome during the last few years. Improvements in oil refining methods have

enabled some refiners to produce high quality straight mineral oils which have given complete freedom from gumming and ring sticking, but even with the use of such oils, for reasons already given, it is imperative to keep the fuel injection system in proper working order. Whilst it is standard practice to utilize only straight mineral oils for diesel engine lubrication, both for tractors and diesel engine road vehicles, one firm of tractor manufacturers, after conducting a considerable amount of research work and much testing as far as their own make of tractor was concerned formed the opinion that better results would be obtained following the use of a specially compounded oil. Tests conducted on certain naphthenic base oils revealed remarkable results with respect to complete freedom of ring sticking over long hours of operation.

A difference of opinion exists among research chemists overseas in connection with the advisability or otherwise of utilizing such inhibitors or compounding materials for the purpose of dissolving certain combustion products (gummy deposits resulting from unburnt fuel). However, this one particular tractor firm, mentioned previously, insists on the use of these specially produced oils in their make of machines. The principle is that the compounding material acts in the nature of a solvent of any gumming compounds and prevents their adhesion to piston skirts and in piston ring grooves and keeps these impurities in solution in the lubricating oil. This ensures that these impurities are removed from the tractor at each draining period. Care must be taken to see that such compounded oils are not used in other makes of tractors where possibly the manufacturers have introduced certain bearing metals which may not be able to withstand any likely corrosive action which might take place as a result of these special compounding materials.

Whilst it is possible from an ocular inspection to determine whether any marked variation has taken place in the lubricating oil taken from a diesel operated tractor—that is, whether it has been thinned down with fuel or thickened up with carbon—the only completely satisfactory method of determining what change has taken place is by means of a laboratory analysis. This work is carried out by reputable oil companies, and it is advisable for diesel tractor operators to have samples analysed at half-yearly periods in order to receive advice as to the mechanical condition as well as the efficient operation of the fuel injection system, it being possible to check up on both these points from a careful analysis of a sample of used lubricating oil.

The maker's instructions in connection with the regular draining of the crankcase oil should at all times be carried out, as such recommendations are only given by the makers after extensive tests have been conducted over long periods of operation. Instances have come under notice where diesel engine tractor operators have endeavoured to effect economy in the consumption of lubricating oil by extending the periods of draining, but this has resulted in false economy and additional wear and tear on moving parts, with consequent expensive overhauls.

One interesting point should not be overlooked and that is in connection with the flushing out of the crankcase of the type of machine

under discussion. Over the past few years prolonged tests in road transport operation have revealed conclusively that with the regular use of flushing oil, cylinder liner wear has been reduced by nearly half, and bearing wear has also been minimised. For instance, 1/1000" per cylinder liner wear was observed at 10,000–14,000 miles of operation without the use of flushing oil, whereas with the use of a flushing oil the same amount of wear was not apparent until after 20,000–24,000 miles of operation. These figures speak for themselves, and similar results may be obtained in diesel engined tractors if, say, after every other draining of the crankcase the engine was flushed out with a good quality flushing oil.

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GEAR CASE AND DIFFERENTIAL.

In gear cases and differentials fitted to all makes of tractors to date, provided that the correct grade of oil in keeping with the maker's specification has been used, the oil level maintained and the used oil replaced at the specified intervals, no troubles have been experienced as far as lubrication is concerned.

The lubricant used in the gear box and differential must not only prevent metal to metal contact, with particular reference to the gear teeth, but it must be sufficiently fluid to penetrate the fine bearing clearances of the selector shafts, as well as being suitable to lubricate completely all ball or roller bearings which may be employed. As it is necessary to change the oil in the gear cases and differentials only after long periods of operation, experience has shown that there is a grave tendency on the part of many operators to ignore such instructions and use the oil indefinitely. By so doing there is a possibility of oxidation and polymerisation taking place and causing a thickening of the oil, which may impair efficient lubrication of all parts, as well as bring about an increase in friction, loss of power and consequent wear. Advice is therefore given to all tractor operators to follow out the maker's recommendations carefully not only as regards the use of correct type of oil for the transmission system, but also that it be replenished at the specified intervals.

WHEEL BEARINGS AND TRACK LUBRICATION.

Wheel bearings offer no serious problem for lubrication and where grease cups or fittings are resorted to, a standard line base grease of a No. 3 consistency for older type machines, and a No. 1 consistency for newer type units, is recommended. These wheel bearings when of the roller bearing or Timken type, should be inspected annually, the bearings being completely removed and cleaned with kerosene, then immersed in engine oil and packed with the correct grade of grease, and following such careful attention long life will ensue.

As far as the lubrication of tracks on those machines so fitted is concerned, these require very careful attention and the maker's recommendation as to periods of lubrication should be followed closely at all times. Referring to the actual tracks themselves, it must be clearly understood that these are not lubricated, but only the rollers on which they operate. Under no consideration should any lubricant be applied

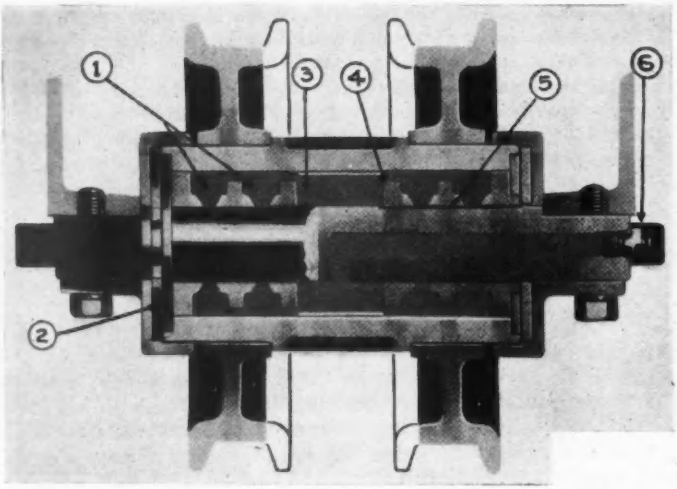

Fig. 15.—1. Oil reservoir pockets. 2. Carbonised steel thrust washers. 3. Large centre oil reservoir. 4. Oil circulating type bronze bearings. 5. Flat surface opening on top of shaft provides positive oiling of shaft. 6. Lubrication fitting protected by guards.

to the tracks, for the reason that where these machines operate in sandy or loose soil areas, sand and soil combined with oil will act as an abrasive in the same manner as an emery powder. The lubrication of the rollers is essential as it will be readily seen that these are carrying the whole weight of the tractor. Roller bearings as fitted to Caterpillar tractors are shown in section in Figs. 15 and 16, while Fig. 17 illustrates the roller as fitted to a Cletrac machine.

In each instance these rollers are so designed that the leakage of lubricant is reduced to a minimum, there being a large annular space in which a copious supply of lubricant is held. A semi-fluid lime base grease or an aluminium stearate base grease has been found by experience to give excellent lubrication for the rollers of the former type of

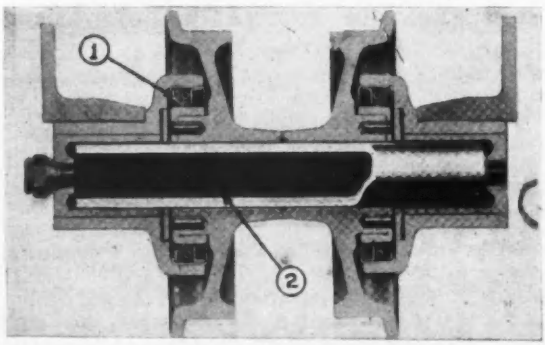

Fig. 16.—1. Leather oil seal ring. 2. Hollow spindle for oil reservoir.

machine, whereas in the latter a lubricating oil slightly compounded, of an S.A.E. 70 rating, has been found to give exemplary service. There are other makes of tracks employed by some tractor manufacturers which carry a recommendation for the use of an S.A.E. 160 transmission oil, and with regular application of this grade of oil excellent service has been obtained.

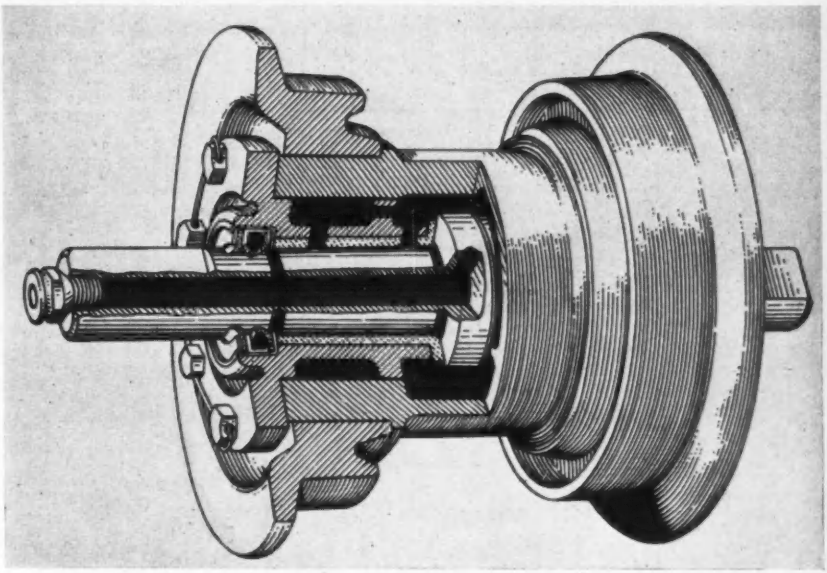

Fig. 17.—Cletrac roller.

On referring to Figs. 16 and 17 it will be observed that leather retaining washers are fitted to prevent leakage of lubricant from the oil space and experience has shown that with the use of a slightly compounded oil the leather is kept in a pliable condition, which assists a better seal being maintained, thus keeping leakage at a minimum.

Although at the commencement three main headings only were selected in connection with the lubrication of tractors, it must not be overlooked that there are many other small moving parts requiring attention from a lubrication point of view, such as steering gear box and steering connections, fan and water pump bearings, magneto and starting engine. It is not proposed to go into detail in connection with these parts; it is sufficient to say that the maker's instructions should be carefully followed out with respect to their lubrication, as in the case of the three sections discussed at some length.

GENERAL.

Selection of Oil:

The manufacturers of tractors, in order to ensure adequate lubrication of their machines, make recommendations as to the most suitable grades of oils to use, and invariably give a specification for the grades, or alternatively make the recommendation according to the S.A.E. ratings.

For the guidance of those who are not familiar with the S.A.E. ratings of motor oils and gear lubricants, the following explanation may prove of interest. The S.A.E. numbers for lubricating oil are simply a scheme for the broad classification of these oils with a more definite meaning than that formerly in use—viz., such terms as "light," "medium," or "heavy." However, S.A.E. numbers have only an approximate meaning in terms of viscosity, and cannot be interpreted for any other property, such as flash point, pour point or any specific physical or chemical value. The viscosity ranges for S.A.E. numbers are indicated in the table:

S.A.E. No.	Saybolt Viscosity, Seconds at—		
	100°F.	130°F.	210°F.
10		90/120	
20	231/384	120/185	50/60
30	384/550	185/250	60/69
40	550/652	250/293	69/75
50	652/1244	293/397	75/105
60			105/125
70			125/150

There are four types of gear lubricants, specified as indicated in the table:

S.A.E. No.	*Viscosity, seconds.*
80	100,000 max. at 0°F.
90	800 to 1500 at 100°F.
140	120 to 200 at 210°F.
250	200 min. at 210°F.

The gear lubricants are further specified for channel point as follows:—

No. 80, —20°F. max.; 90, 0°F. max.; 140, +35°F. max.

It will be observed that in the above specifications are given in terms of Saybolt viscosity, therefore it is essential that when any comparisons are being made between two grades of oil the same viscosity and same temperature be used, that is if the viscosity of a particular grade of oil is stated in Redwood, the figures must be transposed into Saybolt at the right temperature, in order to ascertain with which S.A.E. rating it complies.

Manufacturers have naturally realised that the use of inferior or unsuitable lubricants will impair the effectiveness of their engines and react unfavourably against them. It cannot be stressed too forcibly that it is false economy to use cheap oils, or to attempt to increase the acreage per gallon by the use of an unsuitably heavy oil. One only has to consider figures to realise this. The cost of lubricating oil is only about 2 per cent. of the total operating cost of a tractor. Maintenance repairs and depreciation usually account for about 30 per cent., but an unsuitable oil, by giving rise to ring sticking, carbonisation and heavy wear, may easily increase this figure to 40 per cent.

of the total operating cost. Thus an increase of 10 per cent. in these costs may easily arise by a reduction in the cost of lubricating oil from 2 per cent. to, say, 1½ per cent.

In regard to the use of correct oils and greases. as in other forms of life and effort, there is a well-known axiom which still stands, "We pay for the thing that we need whether we buy it or not," and the relative fact that if we need a thing (high-grade engine oil, for instance) and do not invest in it, we generally "pay through the nose" without having it. The tractor operator who uses incorrect oils and greases to effect a saving pays in wear and tear of his machine. But is this all that he pays? Does he not also sometimes pay in expensive hold-ups, and so on?

Operating conditions vary so greatly that whilst the tractor manufacturer lays down certain recommendations for oil replenishment, these recommendations are intended to cover normal operating conditions, but where abnormal operating conditions prevail, then it is obviously necessary to replenish the engine oil and lubricate other parts, such as wheel bearings and track rollers, at more frequent intervals, and on no account should this point be overlooked if the operator is desirous of securing efficient and continued operation.

There is, of course, a vast difference in the rate at which various oils will deteriorate, therefore it will be readily seen from the foregoing notes that it is advisable always to use only the highest quality oils and greases and the maker's recommendations at all times should be carefully followed.

Approved Varieties for 1940.

The Sugar Experiment Stations Act requires that the Director shall each year issue a list of the varieties which are approved for planting in each mill area. In future, the list will be published in the first *Government Gazette* of the year, so that farmers will have the necessary information available before they make arrangements for planting. However, in order to facilitate arrangements for supplies of plants we will attempt in the October number of the "Quarterly Bulletin" each year to present a forecast of probable changes, if any, which will be made in existing lists of approved varieties. It should be appreciated that this is only a forecast and circumstances, such as an outbreak of disease, might necessitate further changes when the list is finally drafted three months hence.

Northern Mill Areas:

The chief changes in approved lists for northern mills will be in the Hambledon district, where the outbreak of gumming disease necessitates the removal of Clark's Seedling and S.J.4 from the approved list, at least in part. That is to say, if extensive inspections indicate that there are somewhat isolated areas in the southern part of the mill area which are free from gumming disease, then permission to plant S.J. 4 in such areas might be accorded for the 1940 season. Such would, of course, be a temporary measure, since S.J.4 must ultimately go, but it would help tide over the period of trial with other varieties. B.147, Oramboo, Korpi, and other available resistant varieties will probably be added to the Hambledon list.

The variety Q.10 has shown considerable promise in a large pro portion of the variety trials, and consideration is being given to its addition to the approved lists of northern mills. Otherwise, the lists of northern mills will remain much the same as last year, except that D.1135 will be removed from the lists of Mossman (4 acres planted last year), and Babinda (nil planted in 1938).

The small section of the Mulgrave area in the vicinity of Waugh's Pocket will next year be grouped with the Johnstone mills in respect of the approved variety lists.

Burdekin District:

It is not anticipated that these lists will be changed. Several new varieties are under trial, but they will require further observation.

Mackay District:

The variety Q.20 will probably be added to approved lists Some protest was made last year at the removal of H.Q.285 from the approved lists on account of its value as an early maturing cane, and this variety may be restored this year if the demand warrants it. Farmers directly concerned are therefore advised to make immediate individual application for its restoration should they still desire it.

Southern Districts:

No appreciable change is projected for southern mill areas. A number of new varieties have reached the stage of farm trials, but they are not yet ready for consideration for general planting.

A.F.B.

Importance of Molasses as Fertilizer.

Reference was made elsewhere in this Bulletin to the danger of a potash shortage with which Queensland is faced, should overseas supplies of this fertilizer not come forward regularly. In this event, the economic utilization of molasses as a fertilizer assumes a new significance. On current production, some 13,000,000 gallons of molasses are utilized annually in the cane areas, either as fuel, feed, or manure. Allowing an average potash content of 3 per cent. (equal to 6 per cent. muriate of potash), the "available" molasses is equivalent to almost 5,000 tons of muriate of potash, which is capable of supplying the annual requirements of the Queensland canegrowers.

Of course, the most economic utilization of this by-product cannot be made to enable the substitution to be complete. Much of the molasses is available in areas where the use of potash fertilizers is not absolutely essential: it is not possible to spread the material conveniently at a rate less than about 5 tons per acre, which supplies potash in excess of the needs of the crop immediately following; and the transportation of molasses more than a few miles from the mill quickly adds to its cost.

At the same time, it is well to recognise that this material does provide the means for overcoming what may be a substantial difficulty. Mills could assist in alleviating a shortage, should it arise, by carefully rationing such molasses (or ashes produced by the burning of the material), so as to confer the widest benefits on all suppliers. Canegrowers, in turn, could also help out by refraining from all potash purchases, in an emergency, for those fields which have just been given a top dressing of molasses. This piece of advice to the farmer is, of course, one which is made by the Bureau at all times. There is little virtue—and possibly much expenditure—in applying, say, 100 lb. of muriate of potash per acre, to land which has already been given the equivalent of 600 lb. in the form of a molasses application.

H.W.K.

Prosecution for Offence against the Sugar Experiment Stations Act.

Prior to the passage of "*The Sugar Experiment Stations Acts, 1900 to 1938*," all orders for the eradication of diseased sugar-cane were issued under the Diseases in Plants Act. Following the passage of this Act in October, 1938, however, all matters of sugar-cane disease and pest control have been transferred to the Sugar Experiment Stations Act.

In the latter part of 1938 a warning was issued to canegrowers of the Moreton district, drawing attention to the spread of Fiji disease and intimating that drastic action would be necessary in the case of badly diseased fields found during inspections, which would be made in the following January or February. This inspection was duly carried out; seven seriously diseased fields were found and orders to plough out the cane were issued in each case. Six of the recipients of the orders immediately ploughed out their cane, but one grower refused to do so.

As these eradication orders are issued for the good of the farmers of the district generally, and are issued only after mature consideration of each individual case, the Bureau obviously must insist on their being carried out. Legal proceedings were accordingly instituted in this case, and the offending grower was convicted and fined, and the diseased crop has since been destroyed.

Lest anyone feel that the above plough-out orders were unduly severe it should be pointed out that if a day had been spent in any of these fields in November, all diseased stools could have been grubbed out, the spread of infection stopped, and the fields saved. When diseased stools are left in the fields after December, spread of the disease takes place. Some three months' warning was given of the intention to make such inspections and issue eradication orders where necessary. Any person who is not prepared to spend one day looking for and grubbing out diseased plants, so as to protect himself and his neighbours, is scarcely in a position to demand leniency.

A.F.B.

Annual Report of the Director for the Year ended 30th June. 1939.*

STATISTICS OF THE 1938 CROP.

THE yield of raw sugar in Queensland for the 1938 crop exceeded the record tonnage of the previous year by some 15,000 tons. A total of 778,136 tons of 94 n.t. sugar was manufactured. Of this, 455,000 tons were exported, which is substantially above the annual export quota allotted by the International Sugar Council. No. 1 Pool sugar netted £16 19s. 1d. per ton; exported sugar returned £8 4s. 3d., while the average price paid for *all* sugar was £15 2s. 2d.—the lowest recorded since 1914. The total value of the crop was £11,738,000, which is also a record.

The area harvested was 251,064 acres, which represents an increase of 1,400 acres over that of 1937. The yield of cane per acre was 21·3 tons, giving a return of 3·10 tons of sugar. Both figures are record high values for Queensland. This is the third successive season for which the yield of sugar per acre has exceeded 3 tons, and is evidence of the intensive production methods which growers have adopted in recent years.

Growers will doubtless be interested in the average crop returns per acre for the several major districts of the State:—

Acreage Yields by Districts.

District.	Tons Cane per acre.	Tons 94 n.t. Sugar per acre.
Mossman–Ingham	22·58	3·26
Lower Burdekin	26·73	4·17
Proserpine	18·16	2·85
Mackay–St. Lawrence	16·42	2·53
Bundaberg–Gin Gin	23·97	2·67
Maryborough–Childers–Gympie	20·20	2·67
Nambour–Beenleigh	24·18	3·30
State Average	21·28	3·10

MOLASSES PRODUCTION.

During 1938, some 20¼ million gallons of molasses were produced; of this quantity, less than ¼ million was run to waste. The quantity used by distilleries showed a further increase over the 1937 figures, and now stands at 8,275,000 gallons, a smaller quantity than in 1937 was burnt as fuel, while the volume used as manure and for stockfeed purposes was substantially the same as for the previous year.

* Each year the Director is required to prepare for Parliament a Report of the work of the Sugar Experiment Stations. It is now proposed to issue annually a summary of this report, indicating the chief features of the work, in the October Bulletin.

EXPERIMENT STATIONS ADVISORY BOARD.

The Advisory Board held four meetings during the past financial year. Close attention was given to a number of important matters affecting the industry, notably in respect of pest and disease control measures, matters relating to the effectiveness and working strength of different branches of the Bureau staff, and generally to advise the Government on sugar matters which concern the functions of the Bureau. In this way the Board is able to perform a very useful service, and to promote increased efficiency in the operation of the Sugar Experiment Stations.

Mr. N. H. Wellard (Mossman) was elected Deputy Chairman during the year, and presided over three meetings, in the absence of the Hon. the Minister.

DIVISION OF SOILS AND AGRICULTURE.

Field Staff.

During the year a further cadet (Mr. N. Smith) was appointed to the field staff, while a further appointment is under consideration. These will do much to assist the field staff in coping with the ever-increasing volume of work which falls to their lot. Provision is also being made for the appointment of further juniors in the coming year, if suitable trained men are available.

Farm Trial Work.

The farm fertility and varietal trial work has shown further expansion: indeed, owing to the necessity for initiating increased numbers of varietal trials, with the large selection of potential new varieties to be tried out, the fertility experiments have had to be curtailed somewhat. There can be no doubt that the acquisition of superior cane varieties affords one of the most spectacular and lasting ways in which the Bureau can be of assistance to the Industry. Moreover, the only effective means of disease control, and that which must ultimately be adopted, is the propagation of none but highly resistant varieties.

Summarised results of trials harvested during the past and present seasons with new seedling canes will be found elsewhere in this Bulletin.

Soil Analyses.

Our appeal to growers to submit soil samples for analysis met with a most encouraging response; but there is still much room for expansion and we would again urge farmers to avail themselves of a service which costs them nothing, and which can provide them with reliable advice, calculated to enable them to experience the maximum benefits from money expended on artificial manures.

Legume and Fodder Crops.

The search for better types of legume and pasture grasses was continued throughout the year. The most notable result obtained was the establishment of the value of Gambia pea (*Crotalaria goreensis*) as a green manure crop under a wide range of soil and climatic conditions. Experiments were also undertaken with a series of crossbred cowpeas, and the so-called Giant Crotalaria, seed of which was imported from New Guinea.

One must recognise that a hardy, drought-resistant, heavy-yielding crop of this nature, which can be grown successfully as a long fallow cover crop, offers the best means at the canegrowers' disposal for rejuvenating his old lands at a minimum of financial outlay. This is being appreciated more and more by Queensland growers, and the rush for supplies of Gambia pea this year would have taken tons of seed to satisfy it.

A number of newly-imported fodder species, in addition to those reported on last year, are under trial at our three Experiment Stations.

Cultures for Legumes.

The service offered last year to growers desirous of inoculating their legume seeds prior to planting was very keenly sought. Sufficient inoculum was distributed to take care of seed for some 2,000 acres of fallow. Those wishing to obtain cultures again this year may do so, on application.

Experiment Station Field Days.

The Annual Field Days which were conducted this year at Meringa, Mackay and Bundaberg were generally well supported by the local farmers. These functions must be regarded as the annual opportunity afforded growers to inspect at first hand the work which the Stations are doing, in their service, to listen to addresses delivered by technical officers of the Bureau, and to make their personal acquaintance.

At Bundaberg and Mackay, officers of the Stock Department staff gave lectures on Parasites of Farm Animals, while the Meringa field day coincided with the June meeting of the Advisory Board held at that centre.

WORK OF THE EXPERIMENT STATIONS.

The efforts of the Meringa staff to date have been centred largely on cane breeding and pest control. The Station land is of a very mixed quality, and after an adequate area has been selected for seedling propagation and trial work, very little suitable land is available for fertility trials and cultural experiments. This class of work must therefore be confined in the far northern areas, largely to the farm fertility project.

At Mackay, the Station development has now reached the stage where a satisfactory annual planting programme is possible, and the individual blocks have been suitably prepared for experimental purposes. In addition to seedling trial work, fertility experiments and studies on fallowing and trash conservation are now possible.

The Bundaberg Station has in recent years provided us with a fund of useful data respecting many phases of sugar cane agriculture; the introduction of better yielding varieties has been largely responsible for larger tonnages of cane than have ever been harvested on that Station before. The manner in which yields per acre have improved during the past 5 years is illustrated by the graph (Fig. 18) on page 92.

MACKAY STATION.

Varietal Trial.

A varietal trial which was concluded at this Station in 1938, provides results of much interest. It was the first yield trial conducted at that centre with seedling canes raised at Mackay. The yields for the plant and ratoon crops were as follows:—

CROP YIELDS—Plant, First and Second Ratoons.

Variety.	Plant Cane.		First Ratoons.		Second Ratoons.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Per cent.
Q. 813 ..	32·0	16·6	30·4	16·6	14·2	16·3
Q. 20* ..	30·6	**17·6**	34·3	**18·4**	19·3	**17·5**
C. 83	**40·0**	16·4	**42·7**	16·5	**25·0**	15·9
C. 85	32·8	16·8	37·9	16·4	**25·0**	17·1

* Formerly recorded as C. 57.

C.83 has proven an exceptional yielder, while C.85 has also exhibited noteworthy ratooning qualities. Unfortunately, both are so susceptible to downy mildew disease that they cannot be released for commercial plantings in the Mackay area at present.

Q.20 (serial number C.57) has maintained its promise, though inferior in yield to the abovementioned seedlings; but it exhibits an exceptionally good sugar content, and possesses a high measure of disease resistance. The variety has now been distributed for experimental plantings on a wide scale this year.

Observational Varietal Trial.

Another trial was planted in 1937, which included a further six selected seedlings raised at Mackay, in comparison with Q.813. The results of the plant crop are to be taken only as indications of the potential worth of the seedlings; but it is interesting to record that two of these (E.4 and E.45) both outyielded the standard variety, and showed satisfactory C.C.S. tests. These were planted in a full scale trial in 1938, as well as in disease-resistance trials. Both are seedlings of P.O.J. parentage.

Rotational Experimental Block.

This block of 16 acres of rather poor, wet land was subdivided into 8 plots, each of about 2 acres. They are worked in an 8-year rotation, as follows:—1. Plant cane, 2. First ratoon cane, 3. Grass, 4. Grass, 5. Grass, 6. Grass, 7. Grass, 8. Grass. The plant cane is preceded by a green manure crop, while a similar crop is grown and ploughed under after the ratoon has been harvested. All trash and tops are conserved

and eventually ploughed under also. While the land is under pasture, it is grazed by sheep. At the present time, the flocks contain a large proportion of Romney Marsh-Merino crossbred ewes, bred on the Mackay Station. The object of the experiment is to demonstrate the value of stock-fattening, combined with cane production, as a means of improving poor land while deriving revenue therefrom.

The results of the trial to date are summarised as follows:—

Cane Crop Yields.

Plot Number.	Variety.	Harvested.	Nature of Crop.	Cane per Acre.	C.C.S. in Cane.
				Tons.	Per Cent.
1	C. 83 ..	1937 ..	Plant	26·2	15·7
		1938 ..	First Ratoon ..	29·8	16·8
2	Mixed ..	1938 ..	Plant	31·8	15·3

Plot 1 is now under grass once more, while the ratoons from plot 2 will be harvested this year, together with the plant cane from plot 3; plot 4 is now ready for planting.

It is evident that the land is capable of producing plant and first ratoon crops substantially above the district average yields; and the object is to conserve and further build up the fertility in a manner which does not call for a heavy financial expenditure.

The sheep running on the grazed blocks did fairly well during the past year, although there was a scarcity of natural feed during the spring of 1938. They were given a supplementary daily ration, during the period, consisting of—

1-lb chop chop.

1-lb. molasses.

1-oz. peanut or cotton seed meal.

This prevented the animals from falling off in condition to a serious degree, and enabled the ewes to produce their lambs without undue loss.

The flock varied from 37 to 51 throughout the year. The older animals are gradually being disposed of, together with all wether lambs. Unfortunately, the major grass species (*Panicum muticum*) is going back with prolonged grazing, but there has been an increase in the proportion of sensitive plant in the pasture. Moreover, as plots are thrown back to pasture, after cane, attempts are being made to test the value of other fodder grasses, both old and newly imported.

Station Crop Yields.

During 1938, some 24·3 acres of cane were harvested, yielding 495·7 tons, for an average of 20·3 tons per acre.

BUNDABERG EXPERIMENT STATION.

Varietal Trial, varying Interspaces.

Varieties P.O.J. 234, P.O.J. 2725, P.O.J. 2878, and Co. 290 were compared in this block; half of the plots were planted with 4 feet and the remainder with 5 feet interspace. Plant, first and second ratoon crops have now been harvested, and the trial is completed.

The main feature displayed by the results is the superiority shown by P.O.J. 2725 throughout. As a second ratoon, 12 months crop it gave 33 tons of cane per acre, against 27 tons for Co. 290 and less than 22 tons for P.O.J. 2878. The last-named variety did not show to advantage on this block, which was harvested annually. However, it is superior to P.O.J. 2725 as an all-round performer, notably when stood over; but under suitable conditions, P.O.J. 2725 does appear to be the most vigorous one-year-old variety grown in Southern Queensland.

It is interesting to note that there was no difference in average yield per acre, whether the distance between rows was 4 feet or 5 feet. This was true for the three crops.

Varietal Trial, P.O.J. Varieties.

All the well-known P.O.J. varieties except 213 were included in this trial, together with Co. 290. For both crops harvested to date, P.O.J. 2875 leads all other canes by a slight margin, but it was definitely inferior in C.C.S. P.O.J. 2883 gave a very favourable performance, in both cane yield and C.C.S.; it would be added to the approved lists of the South, were it not for the existence of Fiji and downy mildew diseases in these parts. P.O.J. 2940 gave the highest C.C.S. value for the first ratoon crop, though P.O.J. 2725 occupied pride of place for the plant cane. P.O.J. 2878 compared favourably with all other varieties as a one-year-old cane, though it is recognised that the variety does best as a standover crop.

Varietal Trial—Co. 290 v. P.O.J. 2878.

Three crops have now been harvested from this block, and the results are summarised as follows:—

SUMMARY OF CROP YIELDS—Plant, First and Second Ratoons.

Variety.	Plant Crop.		First Ratoon Crop.		Second Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Per cent.
Co. 290	33·0	15·2	14·9	14·8	26·7	10·5
P.O.J. 2878	25·3	15·7	14·3	15·4	23·6	11·6

It is noted that Co. 290 was definitely superior to the "Wonder Cane" in crop yield, though P.O.J. 2878 gave a uniformly better C.C.S.

Of course, these crops were all harvested when one year old; as a stand-over, Co. 290 is not satisfactory, and it is in this respect that the Wonder Cane displays its value.

In planting this trial an attempt was made to determine the value of dropping two setts side by side, as against single plants dropped with similar spacing. For all three crops, a gain of about 10 per cent. in cane yield was recorded, where the double-planting was done. The benefit is attributable to the larger stool produced. As this represents a total gain of about 7 tons of cane per acre for the three crops, the planting method appears worthy of consideration.

Observational Varietal Trial.

A number of seedlings propagated at Bundaberg was planted against Co. 290 and P.O.J. 213 as standards, in order to permit further selections of any showing promise. At least five of these canes appeared superior to the standards, and have been included in systematic yield trials. Four of these were given the numbers Q. 22, Q. 23, Q. 24, and Q. 25 respectively, and the yields recorded in a further trial are discussed below.

Varietal Trial.

The block was planted to Q. 22, Q. 23, Q. 24, and Q. 25, with Co. 290 as standard. The plant cane yields showed:—

CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Co. 290	39·8	14·3
Q. 22	35·9	14·6
Q. 23	27·1	15·6
Q. 24	34·1	14·9
Q. 25	45·4	16·0

Q. 25 thus displayed distinct promise as a commercial possibility. Disease trials have shown it to be highly resistant to downy mildew, though it is susceptible to Fiji disease. A number of propagation plots have been planted this year, on farms where Fiji does not occur. It is hoped that the cane may prove useful in controlling downy mildew, which is now the most serious disease of the district.

Observational Varietal Trial.

The plant crop of a further trial of this nature was harvested during 1938. It included a number of selected seedlings produced at Bundaberg, as well as Comus and Jason, bred by the C.S.R. Company. The yields indicated the promise of two seedlings the serial numbers of which are E. 14 and E. 18, and these were included in a yield trial, with Comus and E. 12, which was selected from an earlier observational trial.

Varietal Trial—Co. 290 v. P.O.J. 213.

These rival varieties each have supporters, and a trial was set out to compare the merits of the canes on the red soil. The plant crop yields were:—

CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Co. 290	34·9	12·5
P.O.J. 213	33·0	13·4

Although Co. 290 gave a slightly higher cane yield, P.O.J. 213 was higher in C.C.S.; the ratoon yields will be watched with interest.

Permanent Trash Trial.

The block carrying this trial might be regarded as the most interesting area on the Bundaberg Station. The field was first planted as a trash trial in 1933, when the variety grown was Q. 813. The trash from the plant crop was conserved by rolling into alternate interspaces, or burned off, depending on the particular plot treatment. The ratoon trash was likewise dealt with, and in 1935, the area was ploughed out. After a fallow, the block was planted once more in 1936, with variety P.O.J. 2725, which is much more suitable for the purpose than the weakly ratooning Q. 813. The crop results to date are:—

Year.	Variety.	Nature of Crop.	Cane Yield per Acre.	
			"Trash" Plots.	"No Trash" Plots.
			Tons.	Tons.
1934	Q. 813	Plant	36·2	36·2
1935	Q. 813	First Ratoon	9·4	13·1
1937	P.O.J. 2725	Plant	19·1	18·6
1938	P.O.J. 2725	First Ratoon	39·5	34·7

These figures are most interesting. The first ratoon Q. 813 was actually disadvantaged by the existence of the heavy trash mulch, and a depressed yield resulted due to death of stools.

The P.O.J. 2725 plant crop yield suggested some slight benefit from the trash which had been ploughed under, while the first ratoons showed a striking increase from the treatment. The gain on the trash plots was 4·8 tons of cane per acre, and it is fully anticipated that the advantage will be maintained in the future.

Potash Trial.

A permanent potash trial was also instituted in 1936. Some plots were to receive no potash for a period of years, while others would be given 150 lb. or 300 lb. of muriate of potash per acre, respectively, for each crop. In this way it was expected that a potash deficiency might be induced in the land, and its magnitude determined.

Two crops have now been harvested from the block, but to date no suggestion of a deficiency can be detected. These results indicate the value of consistent modest plantfood applications, as a means of overcoming what is a normal deficiency on soils of this type.

Average Cane Yields per Acre, Bundaberg Station.

The graph presented here (Fig. 18) illustrates in a striking manner the benefits which have accrued to the Southern cane areas since the

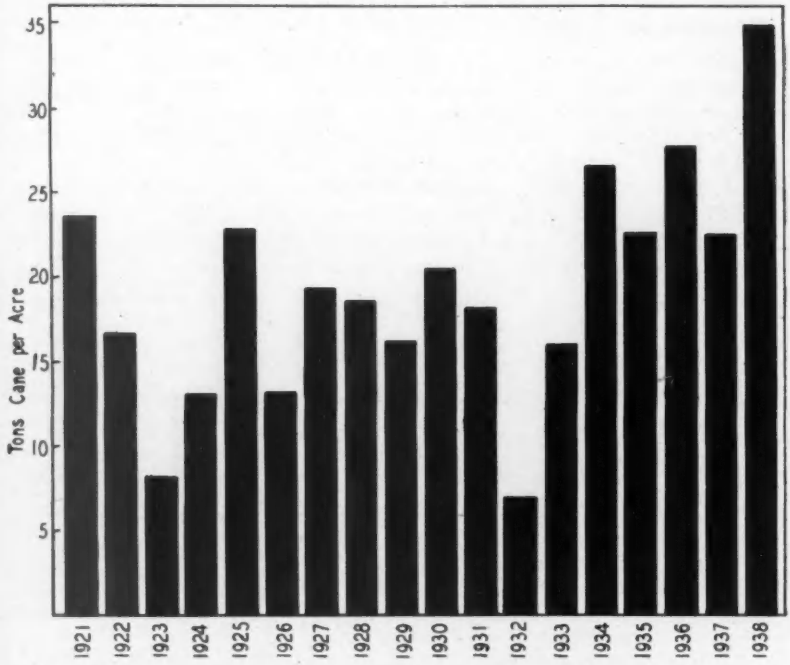

Fig. 18.—Graph illustrating the manner in which cane yields per acre at the Bundaberg Station have improved in recent years.

introduction of varieties like P.O.J. 2878 and Co. 290, which are now the standard canes of the district. Prior to 1932, old canes like Q. 813, with low growth vigour, and which were in some instances susceptible to gumming, had been planted. For the ensuing six years, a marked improvement in acreage yields followed, and the 1938 crop average (34·7 tons) was easily the highest ever recorded at the Station. Of

course, other factors have also contributed; these include green manuring of fallow land, the application of moderate amounts of the correct fertilizer to each cane crop, and the ploughing in of trash and tops. Where these principles are observed, there is no necessity for soils to become depleted or worn-out.

CANE BREEDING AND VARIETIES.

During the year the erection of a glasshouse at the Mackay Station was completed and all three stations are now complete with new seedling equipment—glasshouses, concrete benches, sterilizers, mulch pits for soil, sprays, and so on. With these facilities it is anticipated that no difficulty will be experienced in raising over 20,000 seedlings per annum.

1939 Cross Pollination Season.

In marked contrast to the conditions prevailing in the Cairns district during 1937 and 1938, the 1939 wet season yielded heavy falls of rain over an extended period, as indicated by the following table:—

	1937.	1938.	1939.
	In.	In.	In.
January	8	19	26
February	5	19	37
March	16	3	35
April	5	0·5	9
Total	34	41·5	107

The conditions which determine arrowing are not very well known but certainly under North Queensland conditions the type of rainy season has a big influence. While 1937 and 1938 were notable for an extreme scarcity of arrows, 1939 was characterised by the heavy arrowing of most canes, Q.813 being about the only well known standard which failed to arrow. As a result of this heavy arrowing we were able to make a number of crosses not previously attempted and, in all, over 120 crosses were made during the season. A seedling which is one-fourth sorghum and three-fourths cane was back crossed on to Badila and the progeny will be watched with interest.

Experimental Work.

A considerable amount of experimental work has been carried out in various directions including the drying and storage of seed. Sugar cane seed is very sensitive and does not retain its powers of germinating for very long when stored under ordinary conditions. However it has been found that if the seed is placed in sealed containers, with calcium chloride added to absorb any moisture, and then stored in a refrigeration chamber a little above freezing point, the seed will readily keep for months. Now we are able to store seed we propose to use it in two ways—1, to carry reserve stocks so that a bad arrowing season will not unduly restrict supplies, and 2, germination (with the previous year's seed) will be done early in the season so that the seedlings can be put out in the field at a time corresponding to autumn planting rather than spring planting as at present.

Seedlings on Stations.

Each of the 20,000 or more seedlings planted out on the stations each year represents one stool of a distinct new variety. About 200-250 of these are then selected for further testing, the selections being the consensus of opinion of several selectors. Previously and, in fact, in most overseas countries, the practice in vogue provides for the planting of one row of 8-10 setts of each variety selected; in the next year another selection is made and four separate 1-row plots are planted out. This year we combined the two and planted out 40 stools straight away but placed them all in one plot of 4 rows × 10 stools. This method takes a little extra ground but saves a year and enables us, we consider, to get a much better early idea of the covering-in qualities of the new varieties.

From the 40-stool plots there is a further selection of a total of about 45 varieties which are planted in 1/20 acre plots and in the next year about 12 of these are selected and placed in replicated trials on the stations. That is to say a seedling which was germinated in 1939 would go into a replicated yield trial on the station of its origin in 1942 from which it would be selected and then put out in small farm plots in 1943. It will be seen therefore that little time is lost in getting seedlings on to the farms.

A record of the seedlings in the various trials on the stations, and the crosses represented, has little interest. It is of interest to note, however, that the cross P.O.J.2878 × Co.290 is producing seedlings of extremely good promise on the Bundaberg Station. Nevertheless it remains to be seen how the seedlings of this particular family will stand up to disease since P.O.J.2878 is so highly susceptible to both Fiji and downy mildew diseases.

Q. Seedlings.

The seedling Q.2 is now on the approved variety list for northern mills and is being propagated for test in Central Queensland; its susceptibility to gumming and downy mildew diseases under South Queensland conditions preclude its growth there.

The following are brief notes on the Q. seedlings which have shown promise in farm trials:—

Q. 10 has shown promise of early maturity and high sugar content, is a good striker and fair to good ratooner. It is more resistant to borers than Badila but equally as susceptible to grubs. It is resistant to gumming, top rot and leaf-scald under North Queensland conditions. Its chief drawbacks are its lodging characteristic, a tendency to shoot at the top and susceptibility to rat damage. It will probably be approved for planting in certain northern districts in 1940.

Q. 13 so far shows improved performance as compared with Q.10 in the matter of sugar content and early maturity and habit of growth. It is resistant to gumming and leaf-scald but susceptibility to top rot is of the Badila class. In the absence of top rot it is resistant to borers and its harder rind and more erect habit make it less attractive to rats. It is a good striker and if ratooning is satisfactory it should be a useful cane; it will be extensively tested in North Queensland during the 1939-1940 season.

Q. 19 is still under test but will probably be discarded on account of disease susceptibility. Furthermore, although an attractive looking cane it is late maturing and not then of high sugar content.

Q. 20 is a cane of the Q. 813 type which has performed promisingly in the Mackay district. It is a rather early maturing cane of high sugar content; yields are not heavy but ratooning is comparatively strong. The growth habit is sprawling but the cane does not lodge badly; cover in the early stages is not particularly good. In trials conducted to date it appears resistant to gumming and downy mildew diseases and reasonably resistant to top rot. The variety is being extensively planted experimentally in the Mackay district and will probably be gazetted an approved variety for that area in 1940. Yield trials or farm observation trials with this variety have been set out in North and South Queensland and the Lower Burdekin district.

Q. 23 has shown fairly good resistance to downy mildew disease. It is a lighter cropper than Co.290 but so far has averaged about 1½ units higher in C.C.S. and will, therefore, receive further trial.

Q. 25 performed well on the Bundaberg Station, both as to vigour and sugar content. It is resistant to gumming disease and apparently highly resistant to downy mildew, for which reason it will be tested extensively in farm plots in the Bundaberg district this season. It is susceptible to Fiji disease. Small supplies of this cane have been sent to other areas.

Q. 27 is a hard vigorous cane which has shown some resistance to grub damage and therefore will be tested further although sugar content is on the low side.

Q. 28 will be advanced to farm trial in the Mackay district this year. It is vigorous and fairly resistant to downy mildew but sugar may be low.

Q. 29 did not arrow in the Cairns district this year, and, moreover, has a hard rind. It therefore has two very important requirements of a standover cane and consequently will be further tested.

Other Q. varieties mentioned in last year's report, viz., Q.21, 22, 24 and 26 have now definitely been discarded after further trial.

Other Varieties Advanced to Farm Trial.

No overseas varieties are undergoing trials on farms at the time of writing; the following are seedlings raised by the Colonial Sugar Refining Company either in New South Wales or at Ingham:—

Jason.—This variety has proved highly resistant to all diseases to which it has been exposed. Its growth habit is of the standover type in Southern Queensland, where it is now being tested, but its free arrowing precludes its use for this purpose in Mackay and north. It is not an impressive looking cane, but has yielded good tonnages in the Northern

Rivers of New South Wales as a standover crop. However the sugar content appears to be in the vicinity of a unit of C.C.S. below P.O.J.2878 and the purity also appears low.

Comus is a one-year type of cane of reputed high sugar content and early maturity. It is resistant to downy mildew but highly susceptible to mosaic and Fiji diseases. It will be further tested in all areas.

Juno is a vigorous cane of probably fair sugar content. It is resistant to gumming disease in North Queensland, but probably too susceptible to leaf-scald to be grown in the bad leaf-scald areas south of Aloomba. In the Ingham district, where it is a minor standard, it is reputed not to ratoon well if cut in cool weather. This variety may prove of value in gumming disease areas of North Queensland.

Brutus and Vulcan are two somewhat similar types, giving good individual stalks but rather poor stooling. They are being further tested, but at the present time we do not anticipate that they will become commercial canes in North Queensland. Both are reasonably resistant to gumming and leaf-scald but susceptible to top rot. On their 1938 performance they exhibited rather high sugar content and earlier maturity than Juno.

Transfer of Varieties.

The varieties Q.2, Q.10, Q.13, Q.20, Q.25, Q.29, Juno, 30 S.N.673 and 30 S.N.874, have now been established in all major districts of the State and will gradually go into test plots. Small lots of a number of other varieties have also been sent to one or more districts for test in disease resistance trials before a decision is made as to their further fate. Altogether a total of 30 varieties were sent out to one or more districts from the Quarantine House or the Quarantine garden, while others were transferred from the Quarantine House to the Quarantine garden.

Varietal Statistics.

Under the provisions of the amended Sugar Experiment Stations Act canegrowers are now required to furnish details of the area of each variety planted or harvested by them. A provisional return was made this year but this section of the Act will be rigidly enforced during 1940. Without full knowledge of the facts, growers are apt to form erroneous conclusions as to the relative importance of different varieties; the proposed statistics will supply this knowledge and they will also enable assessments of the true value of different varieties. Returns submitted for Southern Queensland for 1938 indicate that planting was almost entirely restricted to the three varieties P.O.J. 213, P.O.J. 2878, and Co. 290.

There has thus now been a complete changeover in varieties in Southern Queensland, the manner in which this has take place being recorded in Table I. For the purposes of comparison we have drawn a line across this table above P.O.J. 213. All varieties above this line are "old stagers"; all those below were only distributed in recent years.

It will be seen that in 1933 the 5 varieties below this line constituted only 4·9 per cent. of the crop, but five years later they constituted 75·3 per cent. The variety P.O.J. 2714, which constituted 2·2 per cent. of this latter total, has since been disapproved on account of its general disease susceptibility. Judging by the plantings which have been made, however, the remaining four new varieties will constitute more than 90 per cent. of the 1940 crop.

TABLE I.—TONNAGES AND PER CENT. BY TONNAGE OF VARIETIES CRUSHED, BUNDABERG AND SOUTH, 1933–38.

Variety.	1933.		1934.		1935.		1936.		1937.		1938.	
	Tonnage.	Per Cent	Tonnage.	Per Cent.	Tonnage.	Per Cent.	Tonnage.	Per Cent.	Tonnage.	Per Cent.	Tonnage.	Per Cent.
D. 1135 ..	134,000	21·0	183,000	22·6	171,000	19·2	98,000	12·5	48,000	7·6	32,000	3·1
1900 S. ..	75,000	11·7	110,000	13·6	95,000	10·7	73,000	9·3	38,000	6·1	42,000	4·1
Q. 813 ..	97,000	15·1	73,000	9·0	77,000	8·6	57,000	7·2	27,000	4·3	36,000	3·6
Uba ..	99,000	15·4	58,000	7·2	79,000	8·9	43,000	5·5	24,000	3·8	12,000	1·2
Co. 210 ..	48,000	7·5	42,000	5·1	46,000	5·1	23,000	2·9	13,000	2·1	6,000	0·6
M. 189 ..	37,000	5·7	57,000	7·1	31,000	3·4	17,000	2·1	5,000	0·8	4,000	0·4
H.Q. 285 ..	41,000	6·3	38,000	4·8	35,000	3·9	23,000	2·9	13,000	2·1	14,000	1·4
Oramboo ..	14,000	2·2	21,000	2·5	39,000	4·4	28,000	3·6	24,000	3·8	21,000	2·1
Mahona ..	13,000	2·0	23,000	2·9	14,000	1·6	10,000	1·2	4,000	0·7	7,000	0·7
Q. 1098 ..	14,000	2·2	9,000	1·1	7,000	0·7	12,000	1·6	3,000	0·5	5,000	0·5
Korpi ..	..	..	7,000	0·9	6,000	0·7	8,000	1·0	15,000	2·3	15,000	1·5
P.O.J. 213 ..	22,000	3·5	60,000	9·4	101,000	11·3	131,000	16·7	94,000	14·8	143,000	14·0
P.O.J. 2714 ..	5,000	0·8	27,000	3·3	41,000	4·6	30,000	3·8	20,000	3·1	22,000	2·2
P.O.J. 2878 ..	4,000	0·6	53,000	6·6	86,000	9·7	133,000	16·9	142,000	22·5	331,000	32·6
P.O.J. 234 ..	..	..	..	..	12,000	1·3	24,000	3·0	27,000	4·3	42,000	4·1
Co. 290 ..	..	..	..	..	5,000	0·6	43,000	5·4	99,000	15·6	228,000	22·4
Aggregate Percentage	..	94·0	..	94·1	..	94·7	..	94·6	..	94·4	..	94·5
Total Tonnage	640,836	..	808,951	..	890,262	..	783,899	..	633,250	..	1,017,716	..

CANE PESTS AND DISEASES.

There was no significant extension of pest damage into new areas during the year, although a small outbreak of a scale insect pest in the Bingera district is causing some apprehension. Damage from rats and borers was again less than it has been within recent years, but cane grub infestation was somewhat more intense than last year. The disease situation showed a general improvement with two exceptions—the discovery of an outbreak of gumming disease in the Hambledon Mill area and an extension of the downy mildew outbreak in the Bundaberg district.

Facilities for disease and pest control have been placed on a much sounder basis by the enactment, in October, 1938, of "*The Sugar Experiment Stations Acts*, 1900 *to* 1938." This Bill, amongst other things, provides for the very strict control of varieties within the different districts and also tightens up quarantine legislation. A concise statement and explanation of the Bill, in pamphlet form, was posted to all canegrowers in the early part of the year, and continued reference to this pamphlet is strongly advised.

Cane Pests Boards and Cane Disease Control Boards.

The old Sugar Experiment Stations Act made provision for the constitution and operation of Cane Pests Boards. Such Boards are comprised of three Growers' and two Millers' representatives and they are charged with full responsibility for the conduct of their affairs, including the recommendation as to the amount of the levy which is to be collected from grower and miller. Twelve Pests Boards have been created under the Act, while there are a number of Voluntary Boards still carrying on.

The amendment of the Sugar Experiment Stations Act provided for the creation of Cane Disease Control Boards along lines similar to the existing Pests Boards and Disease Control Boards have since been constituted at Mulgrave, Mackay, Bundaberg, Isis, Maryborough, and Moreton. These Boards have all appointed Supervisors who, with varying numbers of assistants, are now carrying out systematic farm surveys and the destruction of diseased stools of cane. A great deal of good work is expected of these Boards, and it is safe to say that if it had been possible to constitute them in Mackay and Southern Queensland five years ago the present downy mildew and Fiji disease problems should have been non-existent.

In addition to the above, the mill areas of Hambledon and Mossman have been gazetted "cane disease infested" preparatory to the creation of Disease Control Boards in these areas. The presence of gumming disease in the Mulgrave and Hambledon mill areas creates a special problem, while small centres of downy mildew disease in the Mulgrave, Hambledon, and Mossman mill areas demand strict attention to prevent spread into new varieties.

The energies of all Disease Control Boards will be directed mainly towards disease detection and the control of diseases, such as Fiji and downy mildew, which can be controlled by the digging out of diseased stools at the appropriate time.

Cane Pest Boards Conference.

The fifth annual conference of Cane Pest Boards was held at Mackay in June and was attended by representatives of 14 Boards and the Bureau of Sugar Experiment Stations. A report of the deliberations of this conference was published in the Quarterly Bulletin for 1st July, 1939. Particular interest was centred on a demonstration of a new form of soil fumigant injector which was invented by a Northern canegrower. This injector is very simple in construction and promises to give improved and cheaper injection of fumigant for the control of cane grubs. It will no doubt be tested widely under ordinary field conditions during the 1940 grub season.

Northern Cane Grub—1939 Season Infestations.

Weather conditions in the area north of Townsville during October-November, 1938, were favourable for beetle emergence from the soil, while the continued rains during the early part of 1939 made conditions favourable for the survival of a large proportion of the young grubs which eventually hatched out. As a result there was an appreciable increase in the intensity of grub infestation in these areas. Fortunately the continued rains also favoured the cane, and the damage done by the grubs was much less than would have been the case if weather conditions had been dry.

In the Mackay district there was widespread obvious damage from this pest for the third season in succession although here, as further north, late autumn rains greatly reduced scale as compared with 1938; heavy losses were experienced on a few individual farms, especially on parts of the St. Helen's Creek flats (around Calen) and (for the first time since 1933) in the Mia Mia district.

Fumigation in the Mackay District.

Although cane beetles have been collected and paid for in the Mackay district for many years, grub infestations have been much above normal during the past three years. In an attempt to make the district conscious of the possibilities of fumigation an experimental campaign was jointly carried out this year by the Mackay Pest Board and the Bureau. It was arranged that the Board should supply injectors and subsidise fumigant purchases to the extent of 50 per cent.. while the farmers were required to supply or employ the necessary labour; supervision was supplied by the Bureau as far as practicable.

Farms for demonstration were selected and systematic diggings (1 stool per square chain) were carried out to determine areas of grub infestation on these farms; 141 acres were surveyed in this manner and 60·5 acres fumigated. Owing mainly to prolonged wet weather and also to some lack of facilities fumigation was unduly delayed, but nevertheless the results appear to have been generally very satisfactory in spite of the increased difficulty of fumigating in the taller cane. With the exception of two farms where unfavourable conditions prevailed, the average complete costs of fumigation were £6 10s. per acre which, with the deduction of the 50 per cent. fumigant subsidy paid by the Board, meant an average cost per acre to the farmer of £4 5s. Where a farmer supplied all the labour his out-of-pocket expenses were of course considerably less than £4 5s. per acre.

The campaign has indicated that if fumigation is to be successfully practised in the Mackay district the following four points must be observed:—

1. There must be organisation and supervision of all stages of the campaign (the appointment of a field supervisor by the Pest Board is a necessary initial step in this direction).

2. Reliable farm grub survey maps are necessary before the campaign can be commenced.

3. Fumigation must be done at the first opportunity after the grubs have concentrated under the stools.

4. In some localities, at least, fumigation will only be a payable proposition in strong rooting varieties. For this reason every effort should be made to retain P.O.J. 2878 by keeping it free of downy mildew.

Grub Damage Cannot be Forecast from Beetle Flights.

We have repeatedly drawn attention to the fact that the extent of grub damage cannot be forecast from the numbers of beetles observed during the flighting season. There are many observed cases of heavy beetle flights being followed by negligible damage and *vice versa*. Last year beetles were relatively scarce during the flighting period in some parts of North Queensland; indeed in some cases there was scarcely a beetle seen and yet there occurred areas of heavy grub infestation. The only way to determine the presence of grubs is by systematic surveys and, since the recommended method involves the digging and examination of only 10 stools per acre, it is not an expensive procedure.

Destruction of Cane Beetle Feeding Trees.

Cane beetles favour certain trees for feeding and they tend to congregate on these trees. As a result it has often been possible to eliminate isolated centres of infection within a district by the removal of "islands" of feeding trees from these centres. The destruction of feeding trees on the boundaries of cane areas is a different proposition and can only be generally successful if the trees are cut back to a distance greater than the flight range of the beetle; and cutting trees back for such a distance is a pretty big order.

Various schemes for tree clearing have been put forward during the year, based on the scheme put into practice by the felling of timber on the eastern slope of the Basilisk Range in the Mourilyan area. Judging by last season's experience it would appear that there has been a reduction of grub damage in the vicinity of the cleared area; on the other hand, there has been an increase of infestation in farms somewhat further south. It must be appreciated therefore, that such schemes may bring about a *redistribution* rather than a *reduction* of the pest, in which case Peter may not enjoy being robbed to pay Paul. It is not possible to judge the success or otherwise of such schemes until after a lapse of several years.

Modified Soil Fumigant Injectors.

The question of cheapened methods of injection of soil fumigants has been discussed at several Pest Board Conferences and as a result

there has been some investigation along these lines. The Mourilyan Pest Board, particularly, has devoted a good deal of attention to possible horse or power drawn multiple units. The most promising development to date is a knapsack hand injector made by a Northern cane grower. Fumigant is carried in a knapsack on the back of the operator and the greater capacity of this container, together with the simple mechanism of the new injector, promises to increase the daily coverage per man by more than 50 per cent. It is expected that this injector will be widely tested under field conditions during the coming season.

The Giant Toad.

The heavy and prolonged wet season in North Queensland has been responsible for a great increase in the numbers of toads and it is probable that the numbers have now reached a maximum in those areas where the original releases were made. It is evident that the toads find the high and dry red soils too hot for their liking and they have a tendency to leave such fields at the time of beetle flights. It is suggested that farmers might experiment with trash rolling in an effort to provide cooler moist conditions for the toads in such fields.

An analysis of the stomach contents of a number of toads shows that they are beginning to eat sugar cane pests; up to 15 "frenchi" beetles were found in the stomach of one toad.

Giant Toads Will Not Poison Fowls.

The giant toad has been blamed for poisoning fowls by a number of people, although commercial poultry breeders on a big scale had denied this. An experiment was carried out to test the possible effect on fowls of: (*a*) drinking water in which toads were kept immersed; (*b*) drinking water which was contaminated with toads' urine; (*c*) feeding on young toads. These tests were much more severe than could be expected under ordinary conditions but nevertheless no ill effects whatever were noticed in the fowls. It is of interest to mention that during the feeding test one fowl ate no less than 142 small toads within an hour.

Ducks will attempt to eat much larger toads than do fowls and there is a chance that they will harm themselves by eating larger toads when really hungry, but they do not seem to attack toads if fed reasonably early in the morning.

Trashing for Beetle Borer Control.

A further series of trashing experiments was concluded last season and they serve to confirm earlier opinions, namely:

1. A single trashing of the cane, either early or late in the season, is useless.

2. Borers are reduced in numbers by repeated trashings but the benefits are not of economic value.

We therefore cannot recommend this practice, but must again emphasise the necessity for field sanitation. If cane has to be topped back early in the season the trash should be burnt and reburnt as soon as possible. The raking of small pieces of cane and discarded stalks into heaps, where they form a moist rotting mass, breeds up thousands of

borers ready to attack young cane. Trash conservation (provided cane is properly topped and there are no discarded cane stalks) is not a serious problem in borer control.

Rats in Cane Fields.

Rat damage has remained at a low level throughout Queensland during the past year, including the Mackay district, where no rat destruction campaigns operate. A good deal of work has been done in clearing up the identity of the various species operating in different districts; although it perhaps sounds uninteresting this work is important since different types of rat behave in different ways. A test of the "bait station" system of feeding poison baits to rats did not indicate that it was any improvement, under Queensland conditions, upon the existing system of scattering baits. Distribution of baits on a ten yards square seemed to be most effective.

Numerous chemicals in the form of sprays have been tested for their value in repelling rats but no success has been obtained. Rat "fences" offer promise of keeping rats out of selected areas but cost of their erection will probably prove prohibitive.

Resistance of Cane Varieties to Rats.

As is well known rats prefer soft canes to hard canes and do much more damage on lodged than in standing cane. Preliminary tests are being made on varieties with the rind hardness machine now used in beetle borer work and this method may assist in the selection of rat resistant varieties. The following counts and tests were obtained from a varietal trial plot in the Innisfail district:—

Variety.	Number Stalks Examined.	Per cent. Stalks Rat Damaged.	Rind Hardness.
Q 2	2,407	0·33	18-20
Q 10	2,110	11·85	4
Q 13	1,811	0·29	12

It will be seen than the two harder canes were much less damaged than the Q.10, but it should also be mentioned that the Q.10 was rather badly lodged.

Wireworms.

In order to permit of accurate determinations of the numbers of wireworms present and the maximum numbers which are liable to cause damage, a power soil sifter has been installed at the Mackay Station. This sifter carries a series of sieves and the wireworms will be separated out from a known quantity of soil and counted. By taking samples from fields which are or are not damaged it will be possible to arrive at an approximate figure of safety.

A New Scale Pest of Sugar Cane.

A scale insect has been found damaging sugar cane in the Bingera district. The varieties attacked are P.O.J.2878 and P.O.J.213, and especially the latter. In bad cases the cane stalks are literally covered with the white scale, and the C.C.S. drops alarmingly. Apparently the insect has been in the country for a long time but has now found stand-over crops of P.O.J.213 particularly to its liking. An investigation of the pest is being undertaken and it is hoped that it will soon be possible to recommend control measures.

Gumming Disease.

Gumming disease is now practically unknown in Southern Queensland and attention is at present focussed on this disease in the Mulgrave area and the recent outbreak in the Hambledon area. The outbreak at Hambledon has occurred several miles from the nearest gum in the Mulgrave area and must therefore be due to the taking of diseased plants into the area.

The chief effect of the disease will be the unfortunate necessity for prohibiting the growth of S.J.4 and Clark's Seedling in the Hambledon area as has already been done at Mulgrave. S.J.4 has performed wonderfully well in this district and its strong rooting and grub resistant qualities make it eminently desirable, but its susceptibility to gumming disease is so high that it will have to go. The list of approved varieties in the Hambledon area will be extended somewhat next year to include gumming resistant canes and the testing of new varieties will be accelerated.

Fiji Disease in Bundaberg District.

Last year we recorded the discovery of fresh outbreaks of Fiji disease in the Bundaberg district, including a bad outbreak in the Woongarra. To cope with this serious disease the Bundaberg District Executive appointed a provisional Disease Control Board which now, under the Sugar Experiment Stations Act, has become a Board with statutory powers. This Board has employed a number of inspectors and a systematic inspection has been made in most parts of the district. As was to have been expected this extensive survey revealed many more centres of the disease, a total of 69 infected farms being found. In the vast majority of these cases the infection consisted of only a few stools and timely action by the Board's inspectors will have resulted in the complete eradication on a number of the farms.

Up till 30th June, 1938, the disease had been found on 49 farms and plantations but appeared to have been eradicated from some of these farms. During the twelve-month period up to 30th June, 1939, the disease appears to have been eradicated on 22 of these properties so that marked progress has been made. It is of interest and reassuring to note that 17 of the 22 farms which were cleaned up during the 1938-1939 period received disease eradication orders. Naturally these were among the worst cases and the results speak well for the effectiveness of the campaign.

The improvement in the position may also be gauged from the fact that whereas last spring it was found necessary to issue 50 eradication orders for Fiji disease during the coming spring less than half this

number will be issued, in spite of the very extensive surveys carried out.

Fiji Disease in Other Districts.

The position has continued to improve in the Isis area, and the Disease Control Board has been able to reduce its inspectional staff to one inspector. The situation is still bad in the vicinity of the Island Plantation in the Maryborough district, and the growth of all susceptible canes has been prohibited in that area. This Board now has an Inspector and assistants carrying out inspection and roguings in the outer areas.

In the Moreton district the position appears to have improved slightly. The Disease Control Board plans extensive inspections for the coming year and, in addition, the issue of about 50 disease eradication orders is contemplated.

Fiji Disease and Varieties.

A number of Fiji disease resistant varieties have been obtained from the C.S.R. Company's nurseries in the Northern Rivers district and these have now been sent out for propagation and subsequent yield trials. Resistance trials have been continued with seedlings and newly introduced varieties. The variety Q.25, which will be extensively tested in the Bundaberg district this year, has unfortunately shown considerable susceptibility to Fiji disease. Nevertheless its high resistance to downy mildew makes it a potentially valuable cane for areas like the Woongarra where the downy mildew situation is dangerous but where Fiji disease can readily be controlled with the existing organisation.

The cross P.O.J. 2878 × Co. 290 has produced an excellent looking lot of seedlings on the Bundaberg Station, and therefore it is important to determine what likelihood there is of such seedlings being resistant to Fiji and downy mildew diseases; for this reason one hundred seedlings of this cross will be represented in current resistance trials to both diseases this year.

Downy Mildew in the Bundaberg District.

This disease has spread in a disconcerting manner in the Bundaberg district during the past two years. The position has been aggravated by two distinct factors: Firstly, the autumn weather in both 1938 and 1939 was unusually warm and moist until very late into the season, thus greatly extending the period over which the spread of this disease takes place. Secondly, the varieties P.O.J. 2878, P.O.J. 213, and P.O.J. 234 (which last year constituted over 50 per cent. of South Queensland's crop) are all highly susceptible to downy mildew.

Owing to the high percentage of these varieties cropped it would not be economic to set out to control the disease by their disapproval unless all other means had failed. The Bundaberg Disease Control Board now has in its employ a strong and diligent gang of inspectors and it is hoped that the endeavours of this gang, plus some improvement in late autumn conditions, will allow of a partial clean up this year. If this is not achieved then resistant varieties will have to be substituted, at least in the Woongarra, and available stocks of these are now being propagated. It must be emphasised, however, that such resistant varieties as are available do not include a variety to equal P.O.J. 2878 in general performance.

Details of distribution are given on page 108 in this issue in an article by Mr. D. R. L. Steindl.

Downy Mildew in the Mossman District.

In past years downy mildew disease was widely distributed in the Mossman district, especially in the variety B.147. With the gradual elimination of this variety the disease has largely disappeared but there must remain small centres of infection, and one of these has recently been discovered, involving several fields of P.O.J. 2878. The variety P.O.J. 2878 is rapidly coming into prominence in the Mossman district, and in 1938 it constituted 36 per cent. of the plantings. Its heavy yields, strong ratooning, resistance to grubs and ability to stand long dry spells make it a very useful variety in this district. On the other hand it is highly susceptible to downy mildew and, if it is to survive, steps must be taken to keep downy mildew within strict control. For this reason the Mossman district has been gazetted a disease infested area and it is proposed to constitute a Disease Control Board which can undertake the responsibility of seeing that adequate inspections are made.

Downy Mildew in Other Districts.

During the year downy mildew was observed in the Cairns, Ingham, Burdekin, Proserpine and Mackay districts, in addition to Bundaberg and Mossman cited above. It therefore constitutes a widespread problem and is of chief importance because it restricts or prohibits the growth of most varieties containing "wild" blood; particular importance therefore attaches to this disease in the Hambledon and Mossman districts where canes of wild type descent are desirable for the control of gumming disease.

The amount of the disease has decreased in the Mackay district, due to the disapproval and ploughing out of P.O.J. 2878, and a further batch of disease eradication orders being issued this year will further improve the position. A Supervisor has been appointed by the Mackay Disease Control Board, and it is hoped that his services will soon be sufficiently augmented to permit of adequate inspectional work being carried out. It is difficult to overestimate the importance of P.O.J. 2878 to growers in the grubby areas of the North Coast but this variety can only be maintained there by the exercise of official vigilance.

Downy Mildew Resistance Trials.

Resistance trials have been carried out in the Bundaberg and Mackay districts and several of the selected seedlings have been found to have satisfactory resistance and will be propagated and tested further for yield and field performance. The variety Q.25, a seedling bred on the Bundaberg Station, appeared particularly resistant and small stocks of this variety have now been established in the Mackay, Burdekin and Cairns districts. The seedling Q.20 appears to be more resistant than Q.813 and hence safe for general planting; this variety has now been set out in plots in all districts.

Downy Mildew in Other Plants.

During the past couple of years we have found several outbreaks of downy mildew disease which were rather suspiciously associated with the presence of a downy mildew disease in nearby corn crops.

Accordingly a trial was carried out to determine what other crops in grasses were likely to help to spread this disease in canefields. All three varieties of corn tested took the disease badly and very much more rapidly than cane, while spores of the fungus which causes this disease were produced in vast numbers on both sides of the leaf—as against the under-side only for cane. It is evident then that the growth of corn in proximity to downy mildew susceptible varieties of sugar cane is an unwise practice. Three varieties of sorghum were also tested and all took the disease but to a less extent than corn and, moreover, very few spores of the fungus were produced on the leaves. It would therefore appear that sorghums might have more resistance than corn and it is proposed to test out this spring some six of the best grain sorghums recently imported from the United States; in trials carried out in Southern Queensland last season these grain sorghums yielded much more grain per acre than corn.

A very slight amount of the disease was observed in Johnson grass and Soudan grass. No symptoms were observed in Guinea grass, Para grass, Panicum coloratum, elephant grass, pearl millet or Japanese millet.

Miscellaneous Disease Investigations.

A considerable amount of investigational work was carried out in leaf-scald, chlorotic streak, root disease and other diseases but as the results are of technical rather than general interest they have not been reproduced here.

Introduction of Varieties.

Actually no varieties were introduced from foreign countries during the period under review, the 1938 importations having been received just prior to the writing of the last annual report and the 1939 importations being not yet to hand; the latter include six varieties from Hawaii and two from the United States. The following varieties were introduced from neighbouring sources:—

From New Guinea: 37 N.G.6.

From Fiji: Marcus; 30 R.115.

From N.S.W.: 30 S.N.225; 30 S.N.362; 30 S.N.451; 30 S.N.673; 30 S.N.874; 30 S.N.1031; 30 S.N.1160; 30 G.1250 and 30 G.1759.

Cultures for the Inoculation of Green Manure Crops.

Canegrowers are reminded that cultures for the inoculation of seeds of cowpea and Poona pea seed are again available on application. This service was inaugurated last year and was very favourably received, and cultures sufficient for the inoculation of nearly 2,000 acres of Poona pea and cowpea were despatched to canegrowers in all parts of the State. A number of the recipients of these cultures have written expressing their great satisfaction with the crops produced after inoculation.

The inoculation of the seed is a very simple matter and full directions are forwarded with each lot of cultures. The cultures will keep satisfactory for about a month if stored in a cool dry place, but as far as possible they should be ordered for delivery just prior to the proposed date of planting.

Leguminous crops inoculated with the right type of nitrogen-fixing bacteria can obtain their supplies of nitrogen from the air instead of from the soil and, consequently, when such a green manure crop is ploughed in the soil is enriched by just that much nitrogen. These bacteria can live in the soil for a considerable period and the crop may become inoculated naturally after planting, but even if it does become inoculated, and forms root nodules, it does not follow that the particular bacteria are the most efficient strain. Undoubtedly the best practice is to make sure that the most efficient strain of bacteria is present by the simple practice of inoculating the seed with a tested strain before planting.

Inoculation of the seed is, of course, only one step towards ensuring a good green manure crop; it is still necessary to plant sound seed in a good seed bed, have soil acidity corrected, and have suitable conditions of moisture. To obtain best results, also, the green manure should be planted as soon as practicable after ploughing in trash and not after a bare fallow.

Applications for cultures should be made to The Director, Bureau of Sugar Experiment Stations, Brisbane; each application should be accompanied by the sum of one shilling and should state the number of bushels of seed it is desired to inoculate.

A.F.B.

A Warning Against Planting "Misses" with a Second Variety.

It is not unusual practice for canegrowers in Queensland, after they have planted a field with one variety, to replace setts which have failed to germinate by planting setts of a second, quick-germinating variety. The result, of course, is a mixed stand. While we do not wish to condemn this practice out of hand it is nevertheless important that growers should only follow the practice with a full realisation of the possible ill-effects.

In the first place, it is essential that the variety used for supplies be an approved variety, otherwise both farmer and miller will be liable to heavy penalties for the growing or crushing of a disapproved variety. The fact that the disapproved variety was only used to supply misses would be no defence.

Secondly, a variety which is approved when planted, but which is subsequently disapproved, can only be cropped for three years after the calendar year of planting; it must then be ploughed out. During the past year we have noted several cases in which the second variety used for planting misses, has since been disapproved, the result being that in order to get rid of this variety it has been necessary to plough out the whole field.

Thirdly, there is the question of disease eradication orders. It is possible that the variety used for planting the misses may become diseased and its destruction rendered necessary, but, in order to destroy the scattered stools, the whole field may have to be ploughed out.

If a second variety must be used for the planting of misses it would be wise, therefore, to choose a disease resistant variety which is not likely to become the subject of a disease eradication order or to become a disapproved variety.

A.F.B.

Disease Distribution in the Bundaberg District.

By D. R. L. Steindl.

FOR the information of cane growers in the Bundaberg district, we have set out below some details of the distribution of Fiji and downy mildew diseases.

During the past winter extensive surveys of farms have been carried out by officers of the Bureau and the Bundaberg Cane Disease Control Board, and it may now be claimed that a very representative survey of the district has been made. Of course, it has not been practicable to inspect standover cane, but ratoons from this will be inspected during the coming season.

The figures given below set out the number of farms on which each disease has been found during the past three (3) years. It should be understood that a number of these farms now appear disease free.

DOWNY MILDEW.

The total number of farms in the Bundaberg district on which downy mildew has been found is now 167, together with 9 plantations. These are divided among the mill areas as follows:—

Bingera.	*Fairymead.*	*Gin Gin.*	*Millaquin.*	*Qunaba.*
34 Farms 3 Plantations	1 Farm 3 Plantations	10 Farms	60 Farms 1 Plantation	62 Farms 2 Plantations

In the Bingera area the centres of infection are at South Kolan, South Bingera and Givelda, with one infected farm on the Ten Mile Road.

The only infected farm in the Fairymead area is at Tantitha, where the disease appears to have blown across the river. The infected plantations in the Fairymead area are in the Woongarra.

At Gin Gin the disease has been found on nine farms in the Currajong and Ferry Hills area and one at Skyring's Reserve, but on all except one the infection is very slight.

Of the 122 diseased farms in the Millaquin-Qunaba area, all except five (one at Springfield, one at Clayton, and three at South Kalkie, with very slight infection) are in the Woongarra, which is the most heavily infected area. On the whole, the Millaquin farms along the Barolin, Boundary and Windermere roads are the worst, but there is some heavy infection in the Qunaba area along the Sandhills and Burnett Heads roads.

FIJI DISEASE.

Fiji disease has been found (though since eradicated in numerous cases) on a total of 116 farms and 6 plantations in the Bundaberg area, and these are divided among the mills as follows:—

Bingera.	*Fairymead.*	*Millaquin.*	*Qunaba.*
33 Farms 2 Plantations	10 Farms 3 Plantations	49 Farms ..	24 Farms 1 Plantation

In the Bingera area the diseased farms are located at South Kolan in the environs of Bingera plantation, Bingera Siding, Ten Mile Road, Kalbar and South Bingera, while isolated infected farms have been found at Sharon, Oakwood, Pine Creek and Tirroan (the latter is actually in the Gin Gin district).

Five of the infected farms in the Fairymead area are at Tantitha, four are at Goodwood, and one at North Gooburrum.

The Millaquin farms infected with Fiji disease are distributed over a fairly large area comprising Rubyanna, the Woongarra, Waterview, North Bundaberg, Gooburrum, the Elliott, South Kalkie, Millbank, and one farm at Kepnock.

The chief centres of infection in the Qunaba area are in the vicinity of Qunaba and Spring Hill plantations, with a few scattered farms throughout the rest of the area.

It is important that inspections should be kept up by the farmers themselves in the areas where disease has been found. Although the spread of downy mildew should have practically ceased by May, the disease is continually showing up in stools that were infected earlier when the weather was warmer, and if these stools are not destroyed they will begin to spread the disease again in the late spring. These remarks also apply to Fiji disease.

Standover Cane and Grub Infestation.

By R. W. Mungomery.

In schemes brought forward for the limitation of cane production within the quota allotted to each mill, the question of adopting a farm peak tonnage has been advocated and has received, or is at present receiving, serious consideration in many mill areas throughout Queensland.

Without wishing to enter into an examination of the pros and cons of the various schemes propounded, and assuming that some form of crop control along the lines of farm peak tonnages will ultimately be brought into operation in at least some of the Queensland sugar districts, it seems almost inevitable, and in some cases desirable, that a certain amount of cane shall be left to standover—inevitable on account of excess production during years when unusually favourable growing conditions prevail and desirable in those districts where the wet season rains are not so dependable and where, in consequence, it would be necessary for each grower to ensure that his yearly production shall be maintained somewhere in the vicinity of his permitted harvestable quota.

Many southern growers have, for years past, had a certain amount of standover cane growing on their farms, and except during droughty periods these crops have presented no special problems. On the other hand such crops have not been popular with growers further north, chiefly on account of the deterioration that usually takes place in the second year of growth, and consequently it may become necessary for northern growers to readjust their variety and harvesting programme to suit this new and changed order, such as we envisage.

We have raised the question of what is to be done in the case of standover cane that becomes grub infested, since the general experience in grub infested areas (having particular reference to the "greyback" grub) is that the most advanced crops are, generally speaking, the most likely to suffer severe grub infestation.

Obviously, if the crop is a heavy one and carrying a fairly high grub infestation, there can be no alternative but to fumigate it if it is to be saved, for otherwise the crop will almost assuredly topple out of the ground and result in an entire loss. Morever, with a fairly heavy crop in sight, fumigation then becomes a good form of crop insurance. If, on the other hand, the degree of grub infestation is light it will probably be wisest not to fumigate, but to take a chance on the amount of damage to be inflicted, and harvest the crop as soon as crushing commences. Standover crops are usually harvested first in any case, so such a procedure would not involve any alteration in the programme of harvesting. In the case of light infestations, it should be possible by means of survey diggings, to form some estimate of the damage likely to be sustained if the grubs remain unchecked, and weigh against this the increased costs of fumigating standover cane, when it will probably be found that fumigation in such cases would not be payable.

It will be found in most cases that growers are not keen to fumigate standover cane, owing chiefly to the trash and the tall or lodged cane impeding the progress of the injectors and operators, as well as the greater difficulty in getting the spear to penetrate into a compacted soil. If, therefore, it becomes necessary to leave some cane to stand over, it should be the aim of the grower to leave it on a portion of the farm that is usually not subject to grub damage. Often it will be found that on certain farms areas of stiffer soil exist in which grubs cause little or no damage, and crops might be left to standover on such soils. As well as being less favourable for the grubs to operate in, these stiffer soils hold moisture better and also serve to anchor the stool more securely in the ground and give that necessary support which is so vital to the crop's existence once the roots commence to be pruned by grubs.

If, unfortunately, the entire farm is subject to grub infestation and damage, it would appear desirable to grow a block of Badila or some similar but harder-rinded cane, which will stand over satisfactorily, remain erect, and allow of fumigation with greater ease than would other varieties which tend to grow in a tangled mass.

Should a cane such as Badila subsequently become badly lodged as a result of excessive growth or high winds, and necessitate being fumigated, the best plan probably would be to fumigate it in the centre of the stools much in the same way as some growers do when fumigating tall grub infested cane that has lodged early as a result of the combined effect of grubs and cyclonic winds.

It would be entirely wrong to attempt to be dogmatic on this subject, and the case for each farm and district will have to be judged on its own merits, but it is hoped that some of the foregoing considerations may be helpful to growers who may wish to make provision against an eventuality such as has been foreseen.

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